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Gypsy and Brown-tail Moths Control

ANNUAL REPORT 1946

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
Bureau Of Entomology And Plant Quarantine

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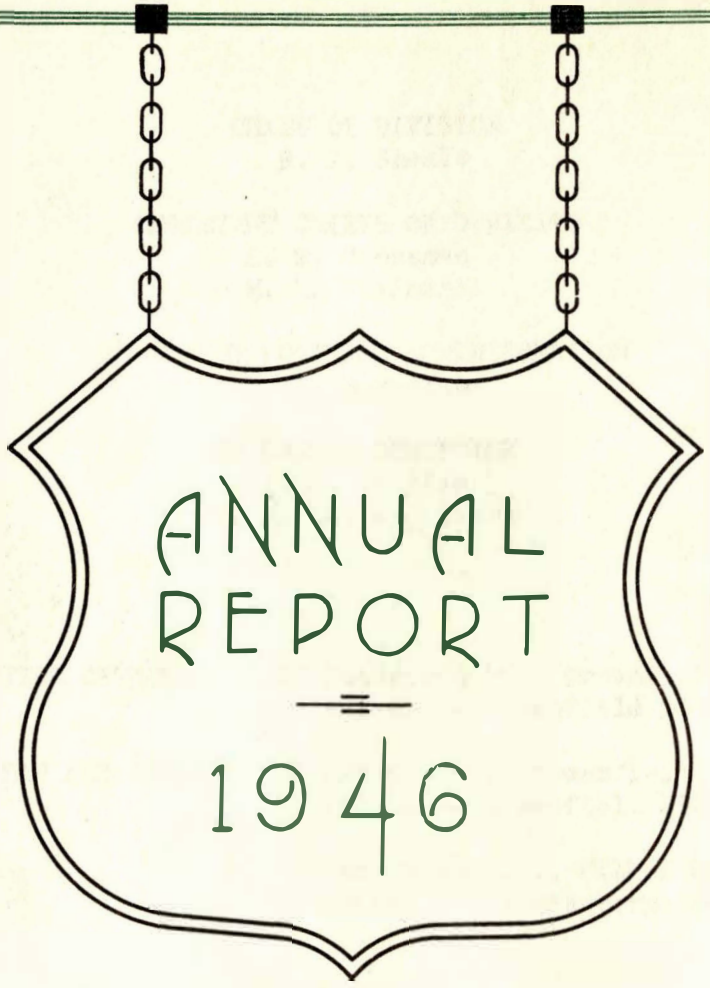

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RETIRED DURING FISCAL YEAR 1946

Owen J. Marley - 10/31/45

FOREWORD

This report reviews the more important phases of cooperative gypsy moth control activities during the fiscal year 1946 and the first quarter of the fiscal year 1947.

The area sprayed with DDT solution during 1946 approximated 127 square miles, or more acreage than has been treated with insecticides in the coordinated Federal and State gypsy moth control programs during any previous 6 years. This significant achievement was attained only because of the use of aircraft equipped with recently devised types of distributing apparatus designed to apply concentrate spray solutions in atomized form and new and novel types of ground spray apparatus using the principle of distributing atomized spray particles in an air blast.

One of the highlights of the season was the action by the Congress of the United States in making available during late May additional funds for gypsy moth control. The $61,000 allotted made possible the purchase of four axial-flow turbine blowers, several tons of DDT, and the use of five aircraft under contract. As a direct result of this increase in available funds, approximately 36,500 acres of infested woodland in the work area in New York, Pennsylvania, and New England were treated with DDT on which otherwise no control measures could have been applied during 1946.

Of equal significance was the progress made in the infested territory east of the suppressive area where gypsy moth control was greatly expanded by the States, local agencies, and commercial pest control operators through applications of DDT by aircraft, blower equipment, and standard types of spray apparatus. All agencies concerned were greatly impressed with the results of such applications on gypsy moths, as well as many other insect pests including flies and mosquitoes, and with the low cost of treatment compared with that for the types of control applied during previous years. Use of this type of control was stimulated largely as the result of demonstrations by this Division which were conducted in several places in Massachusetts, as well as in Maine, New Hampshire, and Vermont.

All phases of gypsy moth control were conducted in close cooperation with State agencies concerned and in accordance with mutually prepared and approved programs of work.

* * *

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SURVEYS

The information obtained by surveys is essential to planning and conducting control operations. An appreciable number of the employees of this Division and its cooperators devote their time to this phase of work during the period from July 1 to March 31 each year.

The sex attractant type of survey is in operation from approximately July 1 through August. It includes collecting of pupae in the field, handling of pupae and the emerging female moths in the shed, and placing and tending the traps in areas where surveys are planned. Manual survey methods are used during the remainder of the survey year.

I. Trap type

The attractant is obtained from virgin female gypsy moths during the summer and most of it is held over the winter for use the next season. During recent years the efficiency of the overwintered material has been increased by chemical treatment by the Division of Insecticide Investigations of this Bureau. Formerly it was used at the rate of 30 tips to an ounce of solvent, but the treatment has made it practicable to reduce each charge by approximately one-third. Experiments conducted during the summer of 1946 indicate that the amount of attractant used can be reduced considerably more and still be effective. This will result in greatly increasing the number of charges obtained from the available material.

All of the attractant is not dispersed into the atmosphere in one season's exposure. Therefore, the charges are salvaged to supplement the treated material for the next season's survey. When both supplies are insufficient to complete the planned survey they are supplemented by using current, untreated material at the rate of 15 tips in 1 ounce of solvent per charge.

The charges are placed in paper cones attached to sheets of paraffined paper or they are inserted in cylindrical traps. The paper or the inside of the cylinder is smeared with a sticky material to catch and hold the males. They are placed in the areas to be surveyed at varying distances, ranging from 1/4 to 2 miles apart, and in some cases used in a gridiron fashion. In some instances after a male is caught, other traps are put out at varying distances around the catch to locate more exactly the site of the infestation.

The largest area ever surveyed by traps (slightly over 6 million acres) was treated during July and August 1946, using 11,744 traps. This is the equivalent of one trap to every 510 acres, if the traps had been evenly spaced in a gridiron fashion. The State cooperators placed and patrolled most of the traps. The attractant was supplied by this Division and assistance in obtaining it was furnished by the Bureau of Forest Pest Control of the New York Conservation Department and the Bureau of Plant Industry of the Pennsylvania Department of Agriculture.

A complete statistical report of the trap survey was prepared and distributed this fall to cooperators and others interested in this phase of operations.

A table summarizing the trapping survey work by States for the last 3 years is in the Appendix.

II. Manual type

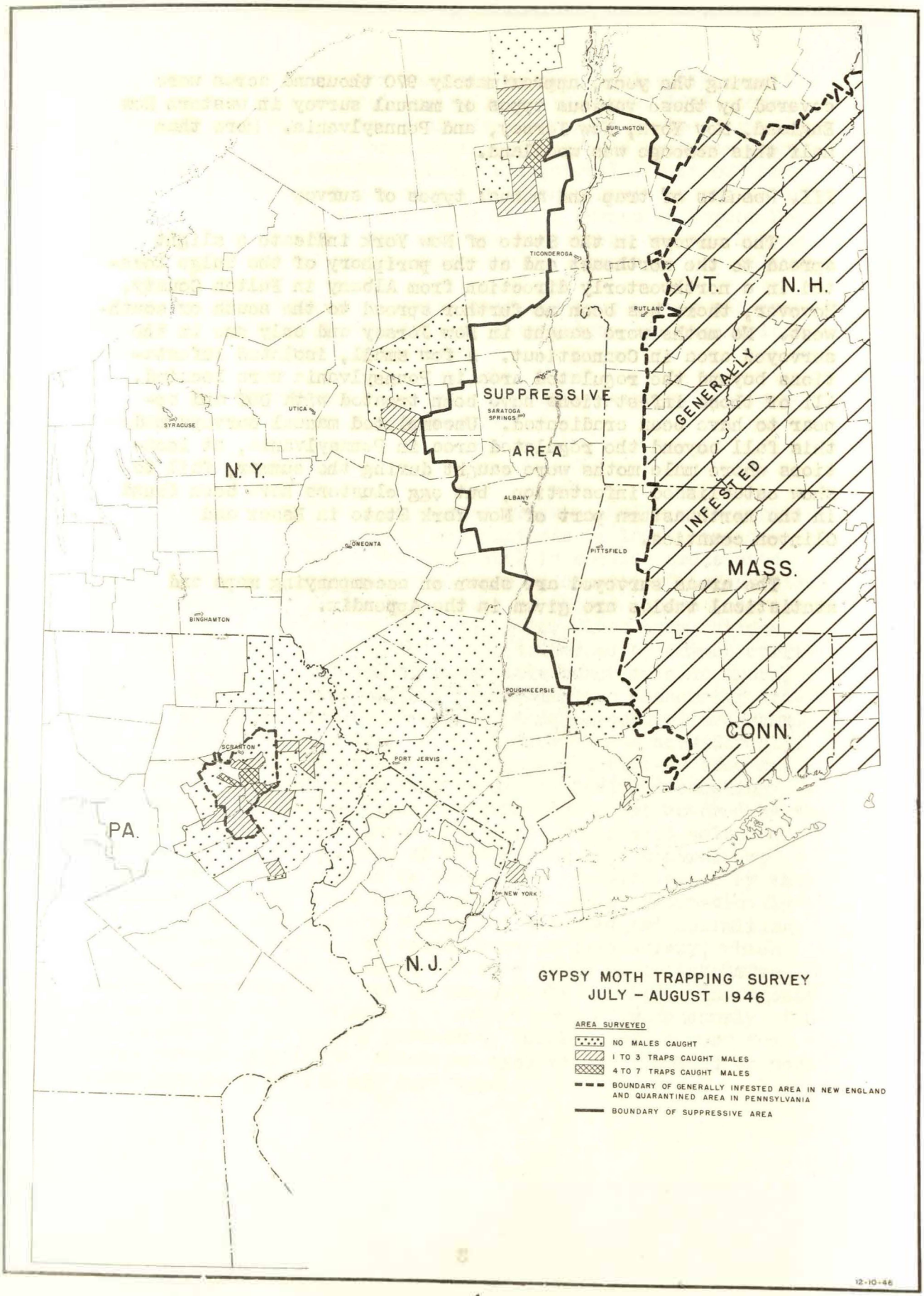
It is necessary to cover large areas annually with experienced personnel making visual examinations to locate and delimit infestations which are suspected in outside areas as a result of trapping catches, to determine density of infestations for the purpose of planning priority of control operations in known infested localities, to make rather close examinations at known infested areas to determine if spread by common carriers is likely, and to conduct surveys in other outside areas, in which no traps were used, where information concerning status of infestation may be needed in planning control programs. The actual method of making these surveys varies considerably. In some instances, it is necessary to make a tree-by tree examination. This intensive type of survey includes checking experimental control operations. Other areas are covered by the spot type survey, where large areas are examined at selected points only for the purpose of determining in a general way whether or not infestation is present over a wide area; by the strip type survey, where experienced employees systematically cover a given area for the purpose of locating and delimiting infested spots; and by the common carrier type survey, which is usually conducted in known infested areas where intensive control operations will not be immediately applied. The amount of area which can be manually surveyed varies tremendously with the actual type of survey performed, ranging from a very few acres per man day in the intensive type to one thousand or more acres per man day with the spot type.

During the year, approximately 970 thousand acres were covered by these various types of manual survey in western New England, New York, New Jersey, and Pennsylvania. More than half this acreage was woodland.

III. Results of trap and manual types of survey

The surveys in the State of New York indicate a slight spread to the northeast and at the periphery of the bulge located in a northwesterly direction from Albany in Fulton County. However, there has been no further spread to the south or southwest. No moths were caught in New Jersey and only one in the surveyed area in Connecticut. A few small, isolated infestations beyond the regulated area in Pennsylvania were located. All of these infestations have been treated with DDT and appear to have been eradicated. Uncompleted manual surveys made this fall beyond the regulated area in Pennsylvania, at locations where male moths were caught during the summer, fail to show established infestation, but egg clusters have been found in the northeastern part of New York State in Essex and Clinton counties.

The areas surveyed are shown on accompanying maps and statistical tables are given in the Appendix.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SARATOGA SPRINGS
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N. Y.
ALBANY
ONEONTA
PITTSFIELD
MASS.
BINGHAMTON
POUGHKEEPSIE
CONN.
SCRANTON
PORT JERVIS
PA.
NEW YORK
N. J.
GYPSY MOTH TRAPPING SURVEY
JULY – AUGUST 1946
AREA SURVEYED
NO MALES CAUGHT
1 TO 3 TRAPS CAUGHT MALES
4 TO 7 TRAPS CAUGHT MALES
BOUNDARY OF GENERALLY INFESTED AREA IN NEW ENGLAND AND QUARANTINED AREA IN PENNSYLVANIA
BOUNDARY OF SUPPRESSIVE AREA
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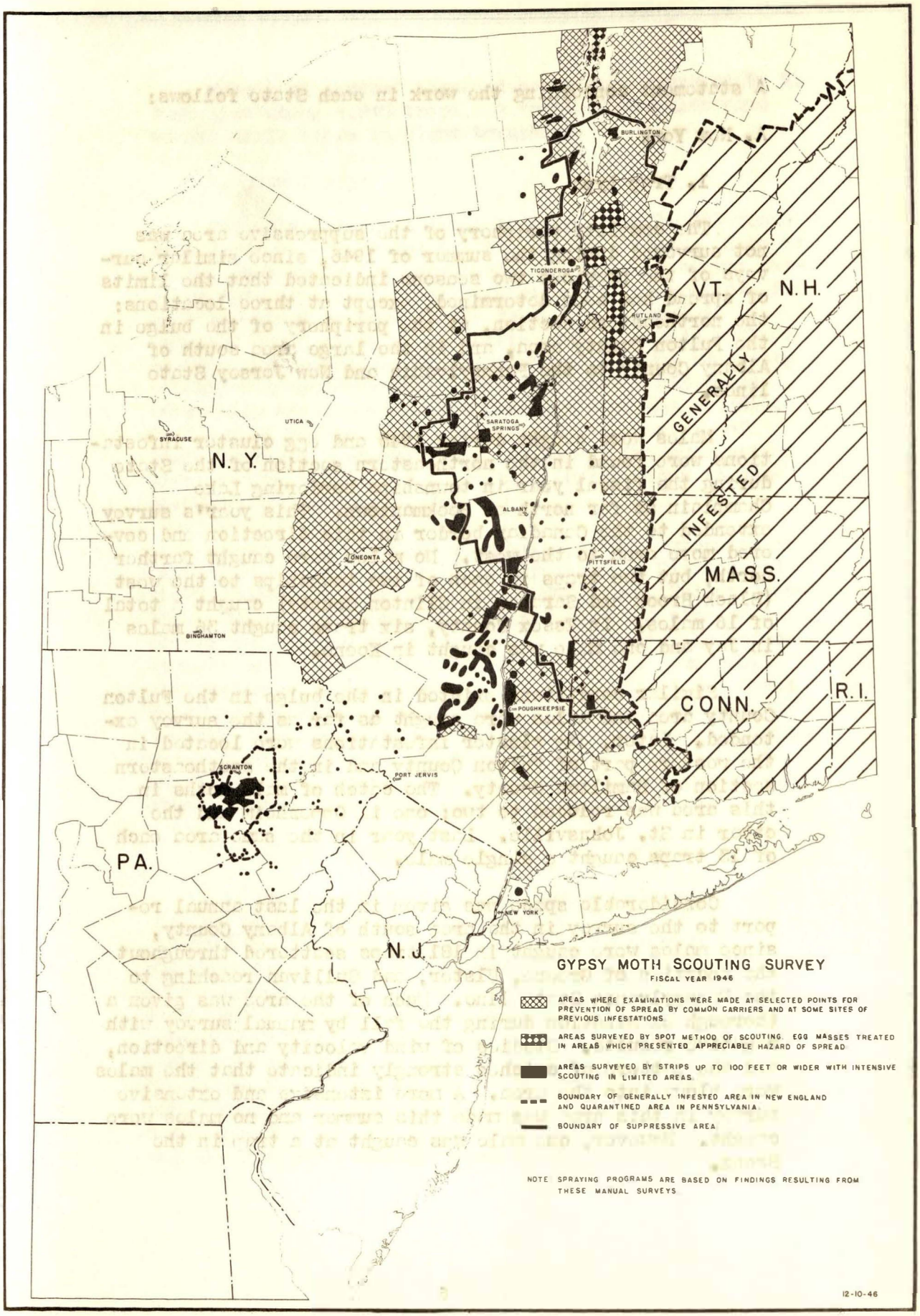
BURLINGTON
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GENERALLY
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PITTSFIELD
MASS.
BINGHAMTON
POUGHKEEPSIE
CONN.
R.I.
SCRANTON
PORT JERVIS
PA.
NEW YORK
N. J.
GYPSY MOTH SCOUTING SURVEY
FISCAL YEAR 1946
AREAS WHERE EXAMINATIONS WERE MADE AT SELECTED POINTS FOR PREVENTION OF SPREAD BY COMMON CARRIERS AND AT SOME SITES OF PREVIOUS INFESTATIONS.
AREAS SURVEYED BY SPOT METHOD OF SCOUTING. EGG MASSES TREATED IN AREAS WHICH PRESENTED APPRECIABLE HAZARD OF SPREAD.
AREAS SURVEYED BY STRIPS UP TO 100 FEET OR WIDER WITH INTENSIVE SCOUTING IN LIMITED AREAS.
BOUNDARY OF GENERALLY INFESTED AREA IN NEW ENGLAND AND QUARANTINED AREA IN PENNSYLVANIA.
BOUNDARY OF SUPPRESSIVE AREA.
NOTE SPRAYING PROGRAMS ARE BASED ON FINDINGS RESULTING FROM THESE MANUAL SURVEYS.
12-10-46

A statement concerning the work in each State follows:

A. New York

1. Trap type

The complete periphery of the suppressive area was not surveyed during the summer of 1946, since similar surveys of the previous two seasons indicated that the limits of spread had been determined, except at three locations: the northeastern section, at the periphery of the bulge in the Fulton County area, and in the large area south of Albany County to the Pennsylvania and New Jersey State lines.

Males were caught during 1945 and egg cluster infestations were found in the northeastern section of the State during the fiscal year in townships bordering Lake Champlain as far north as Beekmantown. This year's survey extended to the Canadian border in this direction and covered more area to the west. No males were caught farther north, but two traps in each of two townships to the west (Black Brook and Saranac in Clinton County) caught a total of 16 males. In Essex County, six traps caught 36 males in Jay and one male was caught in Keene.

Similar conditions existed in the bulge in the Fulton County area and males were caught as far as the survey extended. Later, egg cluster infestations were located in the western part of Fulton County and in the southeastern section of Hamilton County. The catch of male moths in this area was reduced to two; one in Oppenheim and the other in St. Johnsville. Last year in the same area each of 13 traps caught a single male.

Considerable space was given in the last annual report to the survey in the area south of Albany County, since males were caught in 181 traps scattered throughout the counties of Greene, Ulster, and Sullivan reaching to the Pennsylvania State line. Much of the area was given a thorough examination during the fall by manual survey with negative results. Studies of wind velocity and direction, and the pattern of catches strongly indicate that the males were blown into the area. A more intensive and extensive survey in this area was made this summer and no males were caught. However, one male was caught at a trap in the Bronx.

Nearly 35 hundred thousand acres were surveyed in 91 townships using 4,543 traps. A total of 59 males were caught at 17 traps in eight townships.

2. Manual type

During the year, a total of approximately 540 thousand acres were surveyed by the various methods. Surveys at selected spots for prevention of spread by common carriers were continued in all districts and inspections for this purpose were made in 158 townships located in 16 counties in the Hudson, Schoharie, and Champlain Valleys covering approximately 24 thousand acres. The remaining acreage was surveyed in the vicinity of the 322 traps where male moths were caught during the summer of 1945, at sites of previous infestations for the purpose of checking results of spraying, and within the quarantined area for the purpose of delimiting infestations in connection with control plans.

As a result of these surveys, a slight extension of the infested area was noted to the north in Clinton and Essex counties and to the west in Stratford (Fulton County). Two egg clusters were located near the site of a former infestation at Esopus (Ulster County). No infestations were located in Westchester County. The small infestation found and treated the previous year at Dobbs Ferry apparently has been eradicated. Approximately 40 thousand egg clusters were recorded during the year, composed of 213 separate infestations covering 47 hundred acres. Only 2 acres in the State were found with an egg cluster population of over one thousand per acre.

3. General comments

The trap and manual surveys indicate that the extent of the continuous infestation has been determined and that infestation conditions along the periphery of the suppressive area are improved. Early, but unfinished surveys at locations where male moths were caught this summer in the northeastern part of the State have resulted in finding infestations farther west than before. No infestations have been located at the edge of the bulge in the Fulton County area, but only limited examinations have been made and it is possible that gypsy moths may be found in that area when more extensive manual surveys are made this winter. The work that has been

carried on south of Albany to the New Jersey and Pennsylvania State lines, especially during the last 2 years, is very reassuring. It seems probable that if there were any infestations in that region they would have been discovered by these surveys.

B. Pennsylvania

1. Trap type

All townships surrounding and adjacent to the regulated area were surveyed. The surveys included several townships to the southwest and extended east to New Jersey and northeast and north to the New York State line. In addition, traps were used throughout the regulated area to check locations and intensity of infestation, as well as the results of treatment of infested areas with DDT.

Catches of male moths were made at eight traps in six townships beyond the regulated area. One male was caught at each of seven traps and six males were captured at the other trap which was located in a township adjacent to the regulated area. There was a considerable reduction in the number of traps that caught and in the number of males taken as compared with the previous season, both beyond and within the regulated area. No catches of male moths were made within the areas treated with DDT by aircraft during the summer, except in a few cases along the edge near untreated infested territory.

Approximately 2,140,000 acres were surveyed in 101 townships using 5,555 traps, resulting in catches of 95 males at 39 traps in 16 townships, ten of which are in the regulated area.

2. Manual type

A total of approximately 112 thousand acres were covered by various types of manual survey during the fiscal year in the counties of Lackawanna, Luzerne, Carbon, Monroe, Pike, Wayne, and Susquehanna. Of this total, approximately 35 thousand acres were surveyed surrounding sites of the 73 traps at which male moths were captured during the summer of 1945. Although the majority of these catches were made outside the known infested area to the north, south, and east, only seven small infestations were discovered beyond the quarantined area at Price and

Coolbaugh (Monroe County), Lausanne (Carbon County), and Lehigh and Lake (Wayne County). Approximately 60 thousand acres were surveyed within the quarantined area with the scouts deployed 100 feet or more apart in order to obtain data needed in planning control operations. The remaining 17 thousand acres were covered in surveys which included check up work at sites of timber operations to obtain information used in connection with quarantine enforcement, tree-by-tree examinations in residential areas, checking of areas previously treated experimentally with DDT, and training new employees in survey methods.

These surveys resulted in the delimiting of a total of 118 infestations previously known to exist, and the discovery and delimiting of 24 additional infestations. These 142 infestations, totaling approximately 9 hundred thousand egg clusters, cover nearly 20 thousand acres. The most heavily infested areas are located in Pittston and Spring Brook townships, where conditions appear to be especially favorable for development of the pest.

3. General comments

A considerable amount of manual survey work has been carried on at the sites of the traps that caught male moths this season and no egg cluster infestations have been found beyond the regulated area. Large areas within the most heavily infested section were treated with DDT during the summer. This treatment proved to be exceedingly effective. The negative results of the trapping survey near the New York and New Jersey State lines are also very encouraging.

C. New Jersey

1. Trap type

The work in this State was increased during the summer of 1946 in order to survey the townships along the State border adjacent to areas in New York and Pennsylvania where similar surveys were made.

The survey covered approximately 450 thousand acres in 39 townships and 1,003 traps were used. No males were caught.

2. Manual type

The small force of State employees carried on spot type surveys in various localities in the counties of Bergen, Essex, Morris, Passaic, Somerset, Union, and Warren in areas most susceptible to introduction and build-up of gypsy moth infestation. During this survey 2,676 acres of woodland, 494 acres of nursery stock, and more than 17 thousand individual trees in orchards and residential areas were examined. No evidence of gypsy moth was found.

3. General comments

Since the eradication of the gypsy moth in New Jersey, the State Department of Agriculture has continued to maintain a small force of experts to watch for any new establishment of the gypsy moth and to check locations of former infestations in order to quickly discover and eradicate any reestablishment of the pest. Relatively small areas are intensively examined each year. This work has been supplemented by trap surveys with materials furnished by this Division.

D. Connecticut

1. Trap type

Two areas were surveyed with traps. One of them consisting of six entire towns and parts of three others was located west of East Haven adjacent to Long Island Sound. Employees of the State Entomologist's office conducted the survey in this area. A trap in Stratford caught one male moth. In the other area, Federal employees put out a few traps in each of nine towns to supplement the common carrier, manual survey and to check at a few locations of special concern. A limited amount of special survey work was done at Sharon to determine infestation conditions and its relation to catches. No catches of males were made in these towns, except at Sharon which is generally infested.

Approximately 99 thousand acres in 19 towns were surveyed with 493 traps.

2. Manual type

Manual surveys were conducted at various points throughout most of Litchfield County and many towns in New Haven

and Fairfield counties. A large part of this work was at selected sites, primarily for the purpose of prevention of spread by common carriers. Sites of traps where male moths were attracted beyond the suppressive area during the summer of 1945 were examined at Woodbury, Newtown, and Shelton, but no evidence of established infestation was found. Several thousand acres were surveyed in the towns of Warren and Sharon in the suppressive area and the infestations delimited. There was no increase in intensity of infestation noted in those areas this year. The only infestations located beyond the quarantined area were at East Haven, with two small infestations covering 9 acres of residential properties; Wallingford, with two small infestations covering 2 acres of woodland; and Washington, with 60 acres of infested woodland bordering a large infested area in Warren and Litchfield.

Although slightly over one hundred infestations covering 528 acres and totaling approximately 47 hundred egg clusters, were recorded during the year, a much larger acreage of light infestation is known to exist in northern Litchfield County, which was not surveyed due to the manpower shortage.

3. General comments

The infestation in the suppressive area in the northwestern part of the State continues to be light, but it is increasing in the Wallingford section. It has been possible to treat only a few of the most hazardous locations. The limited areas covered by trap and manual surveys in the southwestern part of the State have not resulted in locating any heavy infestations. Plans provide for additional survey work of both types in this area.

E. Massachusetts

1. Trap type

No general trap survey has been conducted for several years except in Stockbridge and West Stockbridge in Berkshire County where special work was continued to obtain information relative to infestation conditions, the best locations for the placing of traps, and the effectiveness of different preparations of sex attractant material. A study of the catches and of actual infestation conditions show that in general, the intensity of

infestations is indicated by the frequency of catches and by the number of males caught at a trap. The catches of male moths in these towns have shown a gradual spread from east to west. Both towns are now generally infested. Occasionally, traps have not caught when placed in known infestation. These have been salvaged and tried in other locations where they have made catches, showing that the charges were satisfactory and that other conditions were responsible for the negative results. Further studies will be continued to determine the best locations for placing the traps.

The Wendell State Forest was used again for testing materials treated by the Division of Insecticide Investigations. The infestation was not as heavy as during the last few years, which made conditions ideal for the tests. The results of this work are encouraging and have furnished leads to the types of treatment necessary to isolate the attractant. If this substance can be isolated in sufficient amount, it may be possible to prepare a synthetic material for use in trap survey work. Even if this is not possible, the improvement of the material that has already been accomplished has resulted in increasing the area which can be surveyed with the available material, as well as increasing its efficiency.

2. Manual type

Only a small amount of survey work was done in the Massachusetts suppressive area this year. This work was conducted chiefly at points where spread might be expected by common carriers, for the purpose of locating centers of heaviest infestation where windspread to uninfested territory was likely and at experimental traps in the towns of Stockbridge and West Stockbridge. As a result of this work, 182 infestations were noted, totaling about 65 hundred egg clusters and covering 11 hundred acres. Large areas of light infestation are known to exist in the Massachusetts suppressive area which were not surveyed this year as no large-scale control operations were planned.

3. General comments

The chief results of the surveys in Berkshire County show a general and gradually increasing infestation over a considerable portion of the area.

F. Vermont

1. Trap type - none

2. Manual type

Practically the entire suppressive area of Vermont was surveyed, primarily to detect and control any infestation found in areas from which host materials might be shipped. All towns in Grand Isle County and several towns in Addison and Rutland counties were surveyed by the spot scout method. Surveys by strip method were conducted at infested areas in Addison, Rutland, and Bennington counties for the purpose of planning control operations. The Vermont suppressive area, particularly north of Rutland, continues to be infested only in isolated spots and is generally light in contrast to the somewhat general infestation noted for several years in western Massachusetts, northwestern Connecticut, and to the west in eastern New York State. A total of 85 infestations were recorded with a total of approximately 37 hundred egg clusters covering slightly less than 200 acres. Over 280 thousand acres were surveyed. The largest infestation discovered was at Waltham (Addison County) where 2,350 egg clusters were located on 17 acres of semi-wooded pastureland.

3. General comments

Although no surveys were made by trapping this year, the infestations are known to be widely scattered rather than general in much of the suppressive area. More effective surveys can be made by the use of traps and it is planned to utilize a substantial number of them in the northern part of the area next year.

* * *

OBTAINING SEX ATTRACTANT MATERIAL

For several years emphasis has been placed on obtaining an increased amount of the sex attractant material to allow for surveying more extensive areas and to supply the Division of Insecticide Investigations with a more liberal supply of it for research purposes. The amount obtained from a single virgin female moth is so small that many moths have to be processed to obtain enough material for research use. This year, in addition to gathering the amount needed for survey work, an attempt was made to obtain 2 hundred thousand female abdominal tips for the Research Unit.

In order to complete such an ambitious program, all field employees of the project were requested to submit suggestions for improving this work. A careful review of the records of the last four seasons' work was made and many helpful suggestions were received and put into practice, or tried in a limited way to determine their merit. As a result of these studies the pupal collection period was shortened. The collecting force was greatly increased and concentrated while the pupae were in greatest abundance. Two rooms, where the temperature remained constant between 58 and 60 degrees Fahrenheit with a fairly high and even humidity, were prepared for aging the females before clipping the posterior abdominal segments into solvent. This reduced a 4-year average mortality of female moths from 16 per cent to less than 4 per cent. The pupae were taken from the field to the shed twice rather than once each day for processing. Men were used on a 24-hour shift to avoid delay in handling the moths which issued in the night. Other refinements were made throughout the entire process.

The Massachusetts Department of Conservation aided the work by furnishing a building in the Freetown State Forest. The Bureau of Plant Industry of the Pennsylvania Department of Agriculture supplied 15 men; 22 were furnished by the Bureau of Forest Pest Control of the New York Conservation Department, and this Division detailed 22 regular and 31 temporary employees to this very important work. The collections were started on July 10, a few days later than usual. By July 24, collections decreased materially and the Pennsylvania State employees were returned to their stations; 2 days later the New York employees were released. The Federal men continued to collect pupae until July 29, when conditions did not warrant further work.

Sufficient infestation was present for a good collecting season, although the development of the gypsy moth was somewhat retarded. The weather, especially at night, was abnormally cool and the caterpillars did not pupate as evenly or rapidly as in previous years. This condition was reflected in the collections. The men averaged only 15 hundred pupae per day per man as compared with a 4-year average of 29 hundred pupae. However, with the large force of collectors available, the greatest number of pupae (1,321,450) ever obtained were processed.

The pupae obtained appeared to be in excellent condition when placed in the trays, but the females emerged slowly. The weather remained cool, with minimum night temperatures outside of the building of 44° F. on July 15, 40° F. on July 16, 37° F. on July 17, and 44° F. on July 18. Temperatures within the shed were slightly higher. The highest daily issuance of female moths was 38 thousand, but under normal conditions it should have been approximately 70 thousand. Rather limited checking of the material indicated parasitism by Sturmia scutellata to be about 25 per cent, which is considerably higher than usual; 2 per cent by Monodontomerus aereus; and 5 per cent by a species of Anomalon, a native parasite which was more abundant than usual. Approximately 40 per cent of the pupae were firm but empty, showing no signs of parasitism, nor were they typical of the wilt disease. Many contained dead and partially developed females. Similar conditions occurred over a considerable part of New England and it appears that the abnormally cool nights occurring during the critical period of pupation were largely responsible for the high mortality.

The average emergence of females for the entire collection was only 21 per cent. Therefore, only 282,153 abdominal tips were obtained. As 55,590 tips were used in current charges for this season's survey and 1,020 were required for tests, only 225,543 tips were obtained for treatment by the Division of Insecticide Investigations at Beltsville, Maryland. That Division will retain for research studies approximately 100 thousand tips and the remainder will be available for next season's trapping survey.

There are 3,850 charges of salvaged material on hand. If the treated material is used at the 22-tip strength, it should provide an additional 57 hundred charges, making a total of 9,550 charges available for next year's survey work. If necessary, this can be supplemented by the use of current material to a limited extent next summer.

* * *

CONTROL OPERATIONS

During 1946, this Division with cooperating agencies planned an ambitious program, considering available equipment and personnel, which involved the proposed treatment of approximately 40 thousand acres in Pennsylvania and the New York-New England area using aircraft, blower types of units, and knapsack sprayers in applying DDT. This program was well under way when an allotment of $61,000 from a deficiency appropriation by the Congress of the United States was made available for use in combating gypsy moths. Additional areas to be treated were selected and markers erected for guidance of airplane pilots. Telegraphic requests for price quotations were sent to all pest control operators in the Northeast who possibly had properly equipped aircraft for spraying purposes. Quotations ranging from $0.65 to $1.80 per acre were received from six bidders. These prices involved furnishing a plane, a pilot, and operating expenses for the planes, such as gasoline, oil, storage and maintenance. The United States Department of Agriculture and/or its State cooperators furnished the insecticide, loaded it into the aircraft, and supervised and directed spray operations. All quotations were accepted because the control season was well under way and all aircraft involved would be needed to treat critical areas before the pest entered into the pupal stage, after which treatment is ineffective. One bidder did not report for duty due to his inability to secure high priority metals needed to finish construction of distributing apparatus. Four axial-flow turbine blowers and several tons of DDT were purchased with the additional funds.

Inclement weather interfered considerably with control operations during the month of May, but by the close of the season on June 26, DDT had been applied on more than 127 square miles of infested area. More infested area was treated in 1946 than during any previous six fiscal years. This was possible only by using aircraft and blowers.

No insecticide other than DDT was used in combating gypsy moths in the suppressive area in New England, New York, or in Pennsylvania during the year, where a Federal-State cooperative and coordinated program was conducted. State cooperators purchased practically all DDT and solvents used in New York and Pennsylvania. These agencies cooperated on an equal partnership basis in planning and carrying out all phases of gypsy moth control.

Control operations and the results of such work follow under appropriate headings. Work in the New York-New England suppressive area, in Pennsylvania, and in New England east of the suppressive area are considered separately. Information concerning use of DDT by commercial pest control operators is also given. Statistical data applying to all areas is given in the Appendix, together with operational costs for the several methods of control.

I. Control operations in Pennsylvania

A. Plan of work

Location and intensity of infestation, upon which the control program was based, was obtained through sex attractant and manual types of survey. Survey methods and the results of such work are described elsewhere in this report.

The objective of cooperative gypsy moth work in Pennsylvania is elimination of the pest from the Commonwealth. Treatment with DDT was first scheduled for the few isolated infestations located beyond the area of continuous spread and then for all infestations of sufficient intensity to constitute an appreciable hazard of natural spread. Surveys disclosed that practically all the latter type of infestations were located in the townships of Pittston and Lackawanna and adjacent thereto. Therefore, it was fortunately practicable from the standpoint of control operations to plan for treatment of units of appreciable size. The program also provided for applications of DDT in and around locations from which materials subject to the restrictions of the State Gypsy Moth Quarantine were likely to be moved interstate or intrastate to points outside the regulated area.

B. Application of DDT by aircraft

Two Bureau-owned biplanes (Navy N3N-3 type) were used in Pennsylvania during the period from April 8 through June 19. One of these planes was equipped with a multiple nozzle (boom-type) distributing apparatus and the other with a twin nozzle device mounted beneath each lower wing, with the conducting tubing located within the wing structure.

Various types of distributing devices used in this work are described in more detail under Spraying Equipment Used on the Gypsy Moth Control Project - 1946.

Windsocks, predominantly white and orange, were attached to trees on the higher elevations for pilot guidance. They were spaced at intervals close enough so one or more were visible at all times. Gas-filled balloons (operated from the ground) were used occasionally as a further guide to pilots, especially in areas where the terrain was precipitous. Pilots had very little operation difficulty with this type of assistance.

One or more lines of glass plates, spaced at intervals ranging from 25 to 50 feet apart, were placed in each area in advance of treatment. Adequacy of coverage with DDT solution was determined thereon by the deposit of atomized spray particles. It was necessary in only a very few instances for any pilot to retreat any area and then only for plots of small acreage.

All aircraft were based at the Wyoming Airport until the latter part of the control season. Servicing facilities consisting of a 1000-gallon capacity mixing unit (secured by transfer from the Division of Japanese Beetle Control) and several Fitzhenry-Guptill sprayers, together with an operating crew, were stationed there. This servicing unit was operated excellently according to all pilots.

Flood warnings due to unusually heavy rainfall in the Susquehanna Valley area were issued during early June. The river reached serious flood stage within a few hours. This necessitated very prompt action on the part of pilots and others assigned to assist them. The aircraft and mixing units were moved from the field to a nearby vacant lot out of flood danger. The entire airport was flooded shortly thereafter. The operators estimated that several weeks of repair work would be required to remove silt deposits from the runways and place the airport in safe operating condition. Therefore, with the cooperation of State police, the Highway Department, borough officials, and public utility companies arrangements were made to fly the planes from U. S. Highway 11 to the airport located at Daleville. This necessitated removal of high tension and other types of wires. The flood subsided shortly after and it was found that the runways could be used. Operations were again resumed at the Wyoming Airport. Toward the latter part of the season, permission was secured to base the planes at a new airport under construction in Pittston, several miles nearer the areas to be treated than the other fields. The cooperation extended by the Pittston Airport officials and the contractors greatly facilitated speeding up of control operations by aircraft.

During the season, DDT solution was applied by Government-owned planes on 23,698 acres and by contract planes on 15,790 acres, or a total of 39,488 acres. The figure for contract spraying includes 40 acres that were retreated because of inadequate coverage on the first operation.

During the early part of the season, before egg hatch had taken place, the formula used consisted of 1 pound of technical grade DDT, 1 quart of xylene, and enough kerosene to make 1 gallon of concentrated oil spray solution. After egg hatch was completed, the formula used consisted of 1/2 pound of DDT in 1 gallon of kerosene. The addition of xylene was not necessary as 1/2 pound of DDT will dissolve in a gallon of kerosene. The materials were mixed in spray units equipped with coils to provide for heating the oils, prior to adding the DDT, to a temperature of approximately 80° F. The solution was applied at the rate of approximately 1 gallon per acre.

Specially selected and qualified personnel were assigned to make observations on wildlife in treated areas during the entire control season. No indications of any injury to birds, fish, or other wildlife, except to a few crawfish, were noted in any of the areas treated during 1946 with DDT. However, a few fish were killed in a small, shallow pool located outside one treated plot. In treating the area involved, the plane in making turns flew over the pool several times. The cut-off device attached to the boom-type distributing apparatus was not working properly and relatively large quantities of the solution apparently fell into the pond. The areas treated included five boroughs located along the river between Wilkes-Barre and Scranton.

1. Results of treatment

As a check on the effect of control, traps baited with sex attractant materials were placed during July and August at intervals of approximately 1 mile apart throughout treated areas. No male gypsy moths were caught on any of these traps, except on a few located close to the outer edges adjacent to untreated areas. Since the traps are known to attract male moths for distances of approximately 1/2 mile, it is believed the males were drawn in from outside areas.

A large portion of the sprayed area has been checked by the manual survey method. A very few egg masses of 1946 origin have been found in two areas, both of

which were sprayed after June 15. This indicates that some gypsy moths may have entered the pupal stage prior to application of DDT, which is not effective against pupae, or that coverage was inadequate.

No gypsy moth infestation has been found in any of the control areas (involving 4,024 acres) treated by aircraft with DDT in Pennsylvania during the fiscal year 1945, nor in the 20-acre plot similarly treated during 1944. Information concerning treatments in experimental plots and results thereof will be contained in reports issued by the research division concerned.

C. Application of DDT by axial-flow turbine blowers

During the year, 13,692 acres were treated with DDT concentrate solution by blower machines. The standard formula consisted of 1 pound of technical grade DDT, 1 pint of xylene, and 7 pints of kerosene.

The air-flow principle will have a permanent place in future gypsy moth control programs. This Division has arranged for the disposal of all our high-pressure power spray units, together with hose and other accessories. A few will be retained for mixing spray concentrates and for loading the solutions into aircraft and blower devices.

1. Results of treatment

Inspections of treated areas as of this time indicate that complete control of gypsy moths was attained for distances ranging from 50 to 300 feet from points from which the machines were operated. In some instances, excellent control was obtained for distances up to 800 feet. The area on which DDT concentrates can be applied and the degree of control of gypsy moths depend primarily on the wind prevailing at the time treatment is applied and its velocity. Complete control of gypsy moths was secured only for distances from 50 to 75 feet from the point of operation against a wind of 15 miles per hour. Eradication was obtained for distances up to 350 feet from the point of operation with a wind of equal velocity moving in the direction of treatment.

D. Application of DDT by knapsack sprayers

Areas treated by this method comprised stone walls, junk yards, back yard plantings, and wooded areas ranging from a portion of an acre to several acres. This type of operation was carried on from late March, before gypsy moths had hatched, up until shortly before the period of pupation toward the latter part of June; 1,038 acres were treated. The formula was the same as that used with the blowers.

1. Results of treatment

Excellent results were obtained in all treated areas, except where vegetation exceeded 10 to 15 feet in height. In such sites, the application resulted only in appreciable reduction of the intensity of infestation. This method of control is recommended only for areas where use of blowers or aircraft is impracticable.

II. Control operations in the New York-New England suppressive area

This area comprises the infested area in New York and that part of New England recently placed under the restrictions of the Federal Gypsy Moth Quarantine.

A. Plan of work

The objective of cooperative gypsy moth control in this area at the present time is threefold: (1) to eliminate the few isolated infestations located outside the area of continuous spread; (2) to eradicate all infestations west of the Hudson River; and (3) to apply suppressive measures on all other areas where the insect is present in sufficient numbers to present an appreciable risk of natural spread unless controlled.

During the season control measures were applied on all known isolated infestations, on approximately 24 thousand acres in the area of continuous spread west of the Hudson River, and on numerous sites in the remainder of the work area, aggregating approximately 3 thousand acres.

B. Application of DDT by aircraft

One Bureau-owned and operated biplane (White-Standard type) was used during the period from April 17 through June

26. During the latter part of May and early June, two additional biplanes (one Stearman and one N3N-3) furnished by contractors reported for duty. Both planes were equipped with a boom-type breaker-bar attachment. At about this time an additional Stearman biplane owned by the New York State Conservation Department was assigned to gypsy moth control. The distributing apparatus installed in this plane is described under Spraying Equipment Used on Gypsy Moth Project - 1946. During the last few days of the control season the Bureau-owned planes assigned to Pennsylvania were used in this area.

Relatively large tracts of infested woodland were treated in the Helderberg Mountains with planes based at Ravena, New York; in Fulton and Saratoga counties, with operations centered at the Perth and Glens Falls airports; and in Essex, Clinton, and Warren counties from airports located at Keeseville and Ticonderoga.

The terrain is very rugged in many of these areas. Pilots performed their assignments in a most satisfactory manner even though flying was difficult.

Areas to be treated were marked with windsocks in the same general manner as described for Pennsylvania. In New York, however, a greater use was made of balloons for guiding pilots. The combination of both types of markers will be generally used in subsequent years until a more efficient system is devised. Glass plates were used to determine adequacy of coverage with DDT solution. In New York the first 1 thousand acres were treated with concentrate oil solution at the rate of 1 2/3 gallons per acre. The formula used consisted of 1 pound technical grade DDT, 1 quart xylene, and sufficient No. 2 fuel oil to make 1 2/3 gallons of spray material. The following formula was used for the remainder of the work: 1 pound technical grade DDT in 1 1/2 gallons of No. 2 fuel oil. This was applied at the rate of 1 gallon of the solution, or 2/3 pound DDT per acre. Servicing units were used at all airports to mix the DDT and solvents and to load the concentrate into the aircraft.

In New York, Federal and State aircraft treated 13,713 acres and 8,700 acres were sprayed by contract planes. In Connecticut, DDT was applied on 300 acres by a Bureau-owned biplane at the rate of 1 pound of DDT in 1 gallon of oil solution per acre. The formula used consisted of 1 pound technical grade DDT, 1 quart xylene, and kerosene to make 1 gallon. A total of 22,713 acres were treated by aircraft in the area.

1. Results of treatment

Preliminary, but rather intensive surveys indicate complete control has been attained throughout a large part of the treated acreage. A few scattered egg masses of current season's origin have been found in areas treated in Albany, Clinton, and Essex counties, New York.

The areas involved are quite precipitous. Wind currents are variable in practically all locations of that type. This may have resulted in drifting of the atomized spray so that the coverage was not adequate. Also the forest growth is higher and the canopy more complete than in most other areas treated in New York or in Pennsylvania. A dosage of 1 gallon per acre was used in all areas, except in the Helderberg Mountains, where 1 2/3 gallons was applied. It may be necessary to use 2 gallons or more per acre, with a proportionate increase in DDT, in fully stocked stands.

No detrimental effect on any kind of wildlife, including birds and fish, was observed.

C. Application of DDT by axial-flow turbine blowers

Three such blowers, one of which was purchased by the New York State Conservation Department and the other two by the Division were used in the same general types of area which were treated in Pennsylvania. Comparable results were obtained. Of the total acreage treated (2,548), 138 acres were located in New York and 2,410 acres in the New England area. The formula used in New York consisted of 1 pound technical grade DDT in 1 1/2 gallons of No. 2 fuel oil, but in New England the formula used consisted of 1 pound technical grade DDT in 1 quart xylene, and enough kerosene to make 1 gallon of solution.

D. Application of DDT by knapsack sprayers

This method of control was used on 2,116 acres in New York and 197 in the New England section of the suppressive area. Several of the formulae used by aircraft and blowers in Pennsylvania, New York, and New England were used. Results were comparable to those given for similar operations in Pennsylvania and the comments on that work also apply.

III. Control operations in New England east of the suppressive area

Since 1922, when the barrier zone arrangement was agreed to by Federal and State agencies, gypsy moth control work east of the zone has been the direct responsibility of the States, with little, if any, participation by the Federal Government. Annual reports of this Division during recent years have included the results of defoliation surveys in this generally infested area. However, they have not described control activities, with the exception of the cooperative research work conducted to a considerable extent in the Wendell Forest area near Greenfield, Massachusetts, to determine the effectiveness of DDT. Use of this area was made possible through the courtesy of A. K. Sloper, Commissioner of Conservation for the Commonwealth of Massachusetts.

The results of such research were so significant, dating from the first field use in 1944, that a considerable number of demonstrations of the effectiveness of DDT when applied in atomized form from airplanes, blower units, and knapsack sprayers have been conducted since that time by the Division in the several New England States in cooperation with appropriate State officials. It is estimated that more than 5 thousand persons attended these demonstrations. They were helpful in arousing the interest of pest control officials in many cities and towns, as well as several commercial pest control operators in control methods which have been used so successfully on an extensive basis in the Federal-State coordinated work areas in Pennsylvania and in the suppressive area of New York and New England.

This Division is interested in the progress made during 1946, and hopes to be of further assistance to State plant pest control officials in this critical area in the development of standardized and coordinated gypsy moth control methods so that the most effective methods can be used throughout the entire infested area. Therefore, this and subsequent annual reports issued by this Division will outline progress made along those lines by State and local agencies and by commercial pest control operators. All agencies concerned with gypsy moth control are urged to conduct their work in accordance with recommendations submitted by the State official in each State responsible for that phase of conservation.

A. Gypsy moth control by State agencies

Connecticut, Maine, Massachusetts, and Rhode Island pest control officials used DDT, primarily in oil solutions, on appreciable acreage. The spray was applied in Connecticut by a contract plane and by a Bean mist blower. In the other States, axial-flow turbine blowers purchased with State, city, or town funds were used. They report results comparable to those obtained for Federal-State cooperative gypsy moth control in the suppressive area in New York and New England, and in Pennsylvania.

Several towns in Massachusetts applied DDT wettable mixtures and emulsions by regular, standard types of spray apparatus. Variable results were obtained, ranging from excellent to fair control of the pest. The principal comment by State and town officials and commercial operators on this type of application was to the effect that little, if any, residual effect resulted from use of such mixtures and that in future seasons many propose to use DDT dissolved in oil. All expressed enthusiasm over the aircraft and blower methods of applying DDT. Indications are that when blower types of distributing apparatus of sturdy construction are available such units will soon replace the standard types of sprayers now in use. The City Forester of Quincy, Massachusetts, applied DDT oil solution by a specially constructed blower of his own design on more than a square mile of residential area. He reports excellent results on gypsy moths, elm leaf beetles, other defoliators, flies and mosquitoes.

B. By commercial pest control companies

At least six commercial operators in New England used blower machines for distribution of DDT in combating gypsy moths and other insect pests during the year. One such company also operated aircraft equipped with distributing apparatus of the boom-nozzle type. Reports from such operators indicate work was conducted in more than 200 towns in New England, ranging from treatment of all shade and roadside trees in entire towns to one or more private estates.

All such concerns used formulae recommended by this Division. They complied with information contained in a release entitled "Suggestions for Use of DDT" which was prepared by Dr. F. C. Bishopp, Mr. R. C. Brown, and Mr. S. S. Crossman of the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture; Commissioner A. K.

Sloper, of the Massachusetts Department of Conservation; and Dr. W. D. Whitcomb of the Massachusetts Agricultural Experiment Station.

Practically all the operators were enthusiastic in reports of the results of the use of DDT. One concern operated two blower units during the period from early June through August. It has recently purchased a biplane and plans to equip it with distributing apparatus for use in applying DDT solutions. At least two other commercial concerns in New England advised that they will have aircraft similarly equipped which will be available for contract spraying with DDT.

Many estates were treated by blower apparatus with DDT solutions primarily for gypsy moth control. Mr. Parker Converse (a manufacturer and Chairman of the Board of Selectmen of Marion, Massachusetts) hired a Pennsylvania contractor to spray his estate with DDT solution by airplane. Mr. Converse had for many years spent several hundred dollars annually for treatment of egg masses with creosote and for spraying the area with arsenate of lead with only fair results. He has been unable to find a single gypsy moth on his property since DDT was applied.

This Division predicts that airplanes and blower types of apparatus will be used much more extensively in subsequent years in the New England area for control of gypsy moths and other insect pests which are susceptible to DDT. It believes that, when all municipalities in the gypsy moth infested area use that very effective and economical method of control, epidemic and widespread infestation of that pest, such as that of 1945 when more than 8 hundred thousand acres were defoliated, will never again occur.

The reaction of the public in New England to use of DDT is indicated by the fact that one commercial pest control operator has already received contracts for use of DDT oil solution in 1947 from over 90 per cent of the persons on whose property he applied DDT by blower equipment during the past fiscal year.

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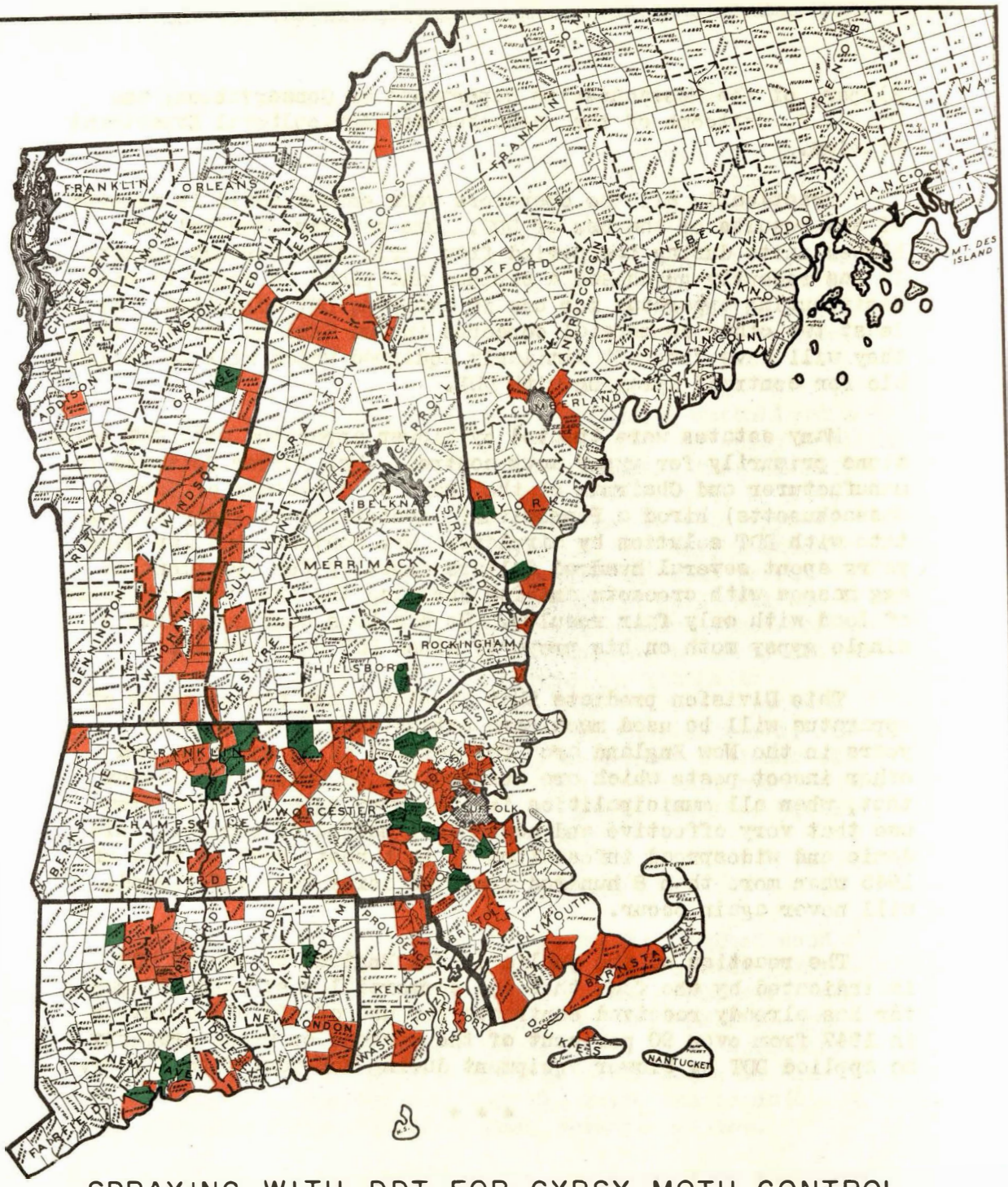


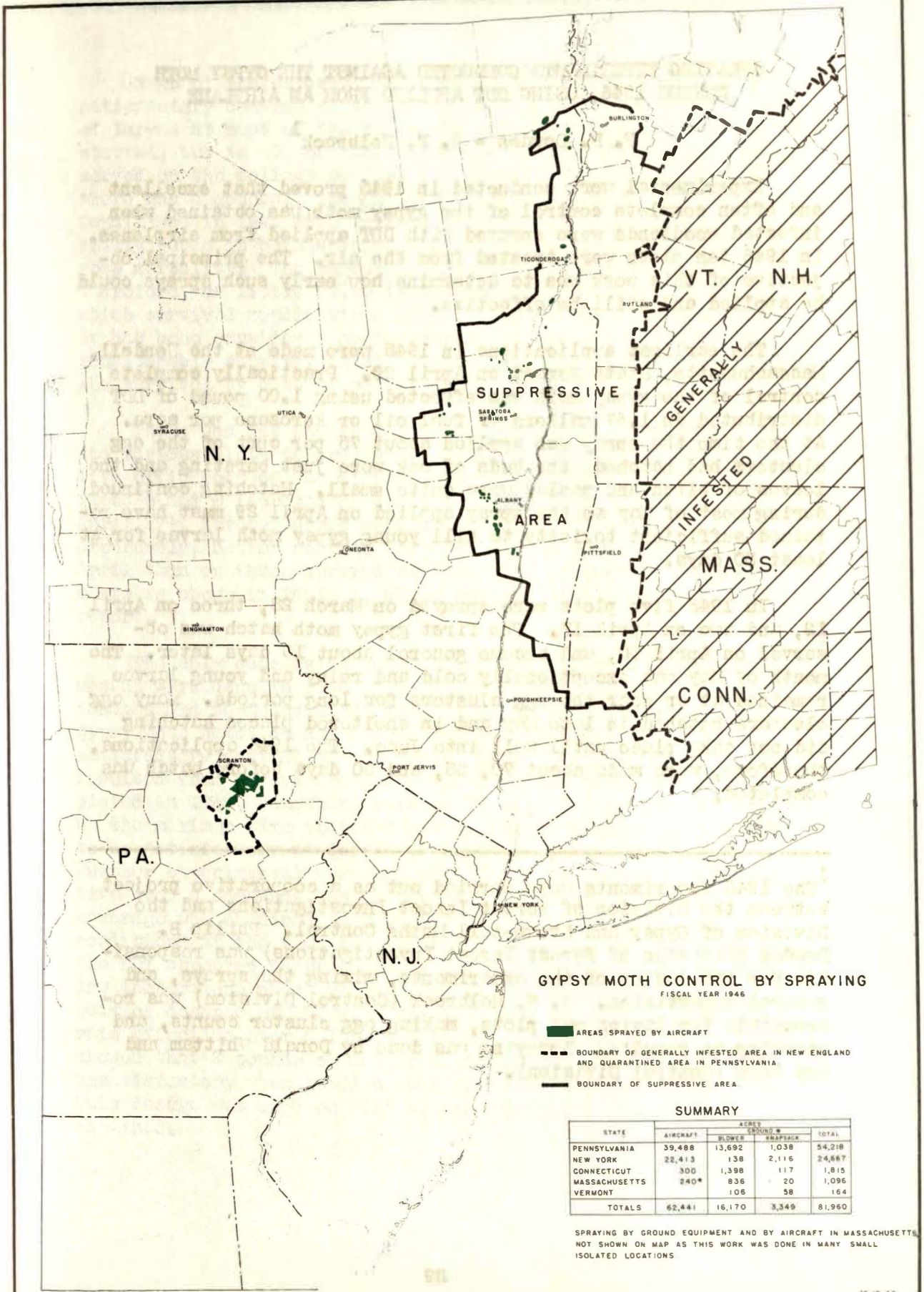
SPRAYING WITH DDT FOR GYPSY MOTH CONTROL IN NEW ENGLAND

1946 SPRAY SEASON

TOWNS IN WHICH COLLABORATING STATE, CITY AND TOWN GOVERNMENTS, AND COMMERCIAL CONCERNS USED DDT IN CONTROL PROGRAMS.

TOWNS IN WHICH FEDERAL GOVERNMENT AGENCIES USED DDT IN EXPERIMENTS AND DEMONSTRATIONS.

12-10-46



GYPSY MOTH CONTROL BY SPRAYING

FISCAL YEAR 1946

AREAS SPRAYED BY AIRCRAFT

BOUNDARY OF GENERALLY INFESTED AREA IN NEW ENGLAND AND QUARANTINED AREA IN PENNSYLVANIA

BOUNDARY OF SUPPRESSIVE AREA

SUMMARY

STATE	ACRES			
	AIRCRAFT	GROUND * BLOWER	GROUND * KNAPSACK	TOTAL
PENNSYLVANIA	39,488	13,692	1,038	54,218
NEW YORK	22,413	138	2,116	24,667
CONNECTICUT	300	1,398	117	1,815
MASSACHUSETTS	240*	836	20	1,096
VERMONT		106	58	164
TOTALS	62,441	16,170	3,349	81,960

SPRAYING BY GROUND EQUIPMENT AND BY AIRCRAFT IN MASSACHUSETTS NOT SHOWN ON MAP AS THIS WORK WAS DONE IN MANY SMALL ISOLATED LOCATIONS

12-10-46

SPRAYING EXPERIMENTS CONDUCTED AGAINST THE GYPSY MOTH DURING 1946, USING DDT APPLIED FROM AN AIRPLANE

P. B. Dowden - R. F. Holbrook[1]

Experimental work conducted in 1945 proved that excellent and often complete control of the gypsy moth was obtained when infested woodlands were sprayed with DDT applied from airplanes. In 1946 ten plots were treated from the air. The principal objective of this work was to determine how early such sprays could be applied and still be effective.

The earliest applications in 1945 were made at the Wendell, Massachusetts, State Forest on April 29. Practically complete control of the gypsy moth was effected using 1.00 pound of DDT distributed in 1.67 gallons of fuel oil or kerosene per acre. At the time the spray was applied about 75 per cent of the egg clusters had hatched, the buds of oak were just bursting and the leaves of birch and poplar were quite small. Hatching continued during most of May so the spray applied on April 29 must have retained sufficient toxicity to kill young gypsy moth larvae for at least 30 days.

In 1946 five plots were sprayed on March 28, three on April 12, and two on April 17. The first gypsy moth hatch was observed on April 30, and became general about 10 days later. The month of May was exceptionally cold and rainy and young larvae remained at or near the egg clusters for long periods. Many egg clusters hatched in late May and in sheltered places hatching did not take place until well into June. The 1946 applications, therefore, were made about 70, 55, and 50 days before hatch was completed.

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[1]The 1946 experiments were carried out as a cooperative project between the Division of Forest Insect Investigations and the Division of Gypsy and Brown-tail Moths Control. Philip B. Dowden (Division of Forest Insect Investigations) was responsible for the design of the experiments, mixing the sprays, and general supervision. R. F. Holbrook (Control Division) was responsible for laying out plots, making egg cluster counts, and checking on results. Spraying was done by Donald Whittam and Ray Dion (Control Division).

None of the experimental applications made in 1946 gave satisfactory control of the gypsy moth. There was a heavy kill of larvae at most of the plots for several weeks after hatching started, but in all of the plots some living larvae were observed on the foliage on June 2. By late June and early July there was a general, though light, infestation in all plots. Conditions in 1946 were unusual in that late larvae and especially pupae in both sprayed and unsprayed areas suffered severe mortality. The number of egg clusters deposited was, therefore, of little value in estimating the number of larvae which survived applications of DDT. Under the circumstances it has been considered more accurate to state that there was considerable survival on all plots, than to attempt to measure the survival by a count of new egg clusters.

There was not enough difference in larval populations at the various plots to draw conclusions regarding the comparative efficiency of the different sprays. In the center of Plots 6 and 8 (sprayed on April 12), and Plot 9 (sprayed on April 17), several acres were almost free of larvae, so, apparently, better control was obtained on plots sprayed in April than on those sprayed on March 28. A summary of treatments is shown in Table 1, which appears at the end of this report.

The only conclusion which seems justified from the experimental work done in 1946 is that DDT sprays applied (in the dosages and formulas used) 50 days prior to the completion of gypsy moth hatch do not retain sufficient toxicity to give satisfactory control of the pest. Since satisfactory control resulted from sprays applied 30 days before hatch was completed in 1945, somewhere between 30 and 50 days appears to be the maximum time that the sprays retain sufficient toxicity to be satisfactory at dosage of 1.00 pound of DDT per acre. Further experimental work may prove that the spray is effective over a somewhat longer period. Unfortunately, poor coverage was obtained on Plot 9 due to rather gusty wind conditions at the time the spray was applied, and the fact that the DDT appeared to precipitate out unusually fast due to the low temperature which prevailed. It is also possible that if heavier dosages of DDT were applied that the sprays would remain effective over a longer period. Work done in 1946, though, showed that 2 pounds of DDT in 2 gallons of oil per acre was unsatisfactory when applied 70 days before hatch was complete. This dosage was used on Plot 4, and excellent coverage was obtained.

TABLE 1.--EXPERIMENTAL SPRAY APPLICATIONS MADE BY AIRPLANE AGAINST THE GYPSY MOTH IN 1946

Plot No.	Location of Plot	Area in Plot (Acres)	Estimated Egg Clusters Per Acre Before Treatment	Date Sprayed	Type of Spray Applied	Lbs. of DDT Per Acre	Gals. of Spray Per Acre	Remarks
1	Wendell	15	1,710	Mar. 28	Emulsion[1]	1	1	Considerable spray drift beyond plot borders.
2	Wendell	15	2,790	Mar. 28	Suspension[2]	1	2	Excellent coverage.
3	Wendell	15	1,534	Mar. 28	Suspension[2]	½	1	Excellent coverage.
4	Wendell	15	1,692	Mar. 28	Solution[3]	2	2	Excellent coverage.
5	Wendell	15	1,234	Mar. 28	Solution[3]	1	1	Excellent coverage - some drift.
6	Wendell	15	1,098	Apr. 12	Suspension	2	2	Good coverage except along road.
7	Erving	10	1,360	Apr. 12	Suspension	1	2	Good coverage except along high tension line.
8	Erving	15	1,818	Apr. 12	Suspension	½	1	Irregular coverage.
9	Warwick	15	2,052	Apr. 17	Solution	1	1	Poor coverage.
10	Warwick	15	1,188	Apr. 17	Emulsion	1	1	Very light but even coverage.

[1]Emulsion - 1.00 lb. DDT, 2 pts. xylene, 0.138 pt. Igepal, water to make 1 gal.

[2]Suspension - Deenol F-50 plus water. (2 lbs. Deenol F-50 equals 1 lb. DDT)

[3]Solution - 1.00 lb. DDT, 2 pts. xylene, kerosene to make 1 gal.

SPRAYING EQUIPMENT USED ON THE GYPSY MOTH CONTROL PROJECT - 1946

Aircraft and blower types of insecticide distributing apparatus used by this Division received considerable public attention during the past year. Many requests were received for information concerning this type of equipment. Such data was furnished to individuals concerned with the protection of forest and shade trees, and field crops in general from damage by insect pests and diseases. These requests for information were received principally from the northeastern United States, but numerous inquiries of like nature were also received from other sections of the United States and from several foreign countries. A high percentage of those interested later came to Greenfield, Massachusetts, to closely examine and observe these insecticide dispensing units in operation. As a result of these inquiries and first-hand observations, a number of blowers were purchased by the cooperating State agencies, cities, towns, and commercial concerns primarily for use in dispensing DDT in gypsy moth control programs. Several commercial concerns installed distributing apparatus in aircraft similar in design and construction to that built and used by this Division. Aircraft so equipped was used in spraying forests and crops with DDT for protection against insect damage.

I. Bureau-owned aircraft spraying apparatus

A. White-Standard biplanes

A White-Standard biplane equipped with special insecticide distributing apparatus of the spinner disc type designed and built by Bureau personnel was used effectively again this year in gypsy moth control work.

The spraying apparatus consists of a 110-gallon, aluminum, insecticide tank mounted in the front cockpit of the biplane; a 2-inch pipe line extending from the outlet (located at the low point in the tank) to the center of a 12-foot cross boom (2 inches in diameter) attached to the lower longerons to the rear of the pilot's cockpit; an insecticide distributing assembly mounted at each end of the cross boom; and gauges and operational controls mounted in the rear cockpit readily accessible to the pilot. On the forward end of each insecticide distributing assembly is mounted a six-bladed fan connected by a steel shaft about 18 inches in length to a set of concave, steel discs approximately 14 inches in diameter mounted at the rear of the assembly. Power to rotate the insecticide dispensing units (located outside of the slip stream) is derived from the forward motion of the aircraft. Each unit is equipped with a brake so

constructed that it can be applied or released by the operation of a single control lever mounted in the pilot's cockpit.

In flying the airplane at approximately 80 miles per hour (the usual operational speed for this type of aircraft in spraying forested areas) these dispensing units rotate at about 2,500 r. p. m. In operation, the insecticide flows by gravity from the tank through the connecting pipe line and cross boom to the rear bearing housing of the distributing unit into a 2 5/8-inch cavity in the center of the discs. It then flows onto and spreads thinly over the concaved surfaces of the discs and by centrifugal force is thrown into the surrounding air from the peripheries of the discs. The force with which the concentrate is thrown from the rotating discs and the air blast resulting from the forward movement of the aircraft breaks up the insecticide into very finely divided particles so that it drifts onto the foliage in mist form. The insecticide distributing head assembly of this apparatus is constructed to be interchangeable and readily removable without disturbing the spray boom assembly. Valves controlling the rate of flow of the insecticide concentrate are installed in the distributing heads close to the spinner disc assembly. This eliminates drooling which would occur immediately after closing the valves if mounted elsewhere in the dispensing apparatus.

This apparatus has operated very satisfactorily during three control seasons and has effectively dispensed DDT, arsenate of lead, and cryolite in concentrated form. It does not depend on the use of pressure pumps or nozzles and, therefore, can be operated effectively with any concentrate, either abrasive or not, provided it is of a consistency that will readily flow by gravity.

Each distributing head assembly was equipped with four discs in the first 2 years of operation. On the basis of tests conducted during the fall of 1945, it was determined that in dispensing DDT in oil concentrate form two discs on each such unit were sufficient. The apparatus was so equipped for the 1946 season.

The co-inventors have made application for a Public Service Patent on this device which is now pending.

B. N3N-3 biplanes

1. Equipped with insecticide dispensing apparatus employing twin nozzle heads

Two biplanes of this type were equipped with insecticide dispensing apparatus employing twin nozzle heads designed and

constructed by Bureau personnel. A 45-gallon gasoline tank salvaged from an N3N-3 biplane was used as an insecticide tank in one plane and a rubber tank of about 70-gallons capacity (manufactured for use as a gasoline tank on the Army P-40 type airplane) was used in the other. The insecticide distributing apparatus installed on these two biplanes were otherwise identical.

In this dispensing apparatus, plastic tubing is installed inside each lower wing to carry the insecticide concentrate from the pressure pump to twin nozzles mounted under the lower wings close to the wing tips. A gear type pump equipped with a suitable breaking device is mounted on the under side of the fuselage along the center line of the aircraft. It is powered with a six-bladed windmill (propeller type) which rotates at approximately 2,700 r. p. m. and develops a pump pressure of 120 pounds in operation with a forward air speed of 80 miles per hour. Self-closing valves of special design and construction are mounted directly behind the twin nozzles in order to eliminate drooling when closed at the end of each flight strip. While these valves are closed, the insecticide concentrate bypasses through the relief valve into the bottom of the solution tank, thus providing some agitation to the concentrate within it. Various nozzles have been tried and to date the Spraco Flat Spray Nozzle has proved most satisfactory. Foreign matter smaller than the orifice readily passes through this type of nozzle without clogging. In gypsy moth control work these units are regulated to dispense approximately 20 gallons of DDT concentrate per minute. However, the output can be readily regulated by using discs with a larger or smaller orifice and by increasing or decreasing the pump pressure.

This apparatus produces an even and effective spray pattern in dispensing DDT oil concentrates at distances ranging from 25 to 50 feet above the tree tops, the approximate height at which airplanes of the N3N-3 type are normally flown in spraying forest areas. The space between the twin nozzle mountings described above may be too great for even distribution of the insecticide in treating truck crops or low growing vegetation where low flying is required. Therefore, one of the N3N-3 biplanes now being made ready for next season's use will be equipped with an additional twin nozzle assembly which will be mounted under the fuselage close to the tail of the aircraft. Electrically-operated solenoid valves

will also be installed on this biplane in order to determine whether or not valves of this type are more satisfactory than manually-operated valves now in use.

2. Equipped with multiple-nozzle type dispensing apparatus

An N3N-3 biplane equipped with apparatus for aerial spraying was loaned by the Division of Domestic Plant Quarantines for use in gypsy moth work during the 1946 control season.

The dispensing apparatus installed on this biplane consists of an insecticide tank; two pressure pump units; a two-section, multiple-nozzle type spray boom; a relief valve, which discharges into the top of the solution tank; and pressure gauges and operational controls conveniently located for the pilot in the rear cockpit. The tank (constructed of aluminum) is of 73-gallons capacity and is installed in the front cockpit. A centrifugal type pump, powered by a four-bladed wooden windmill (propeller type) through a connecting steel shaft, is mounted on each of the two landing struts. In operation, the insecticide flows from the solution tank to each of the pumps where it is forced under approximately 40-pounds pressure to a three-way control valve located behind the instrument panel in the rear cockpit, through a Y connection into the spray booms, and is ejected from evenly spaced nozzles into the surrounding atmosphere as fine spray. When the three-way valve is adjusted to prevent passage of the insecticide into the spray booms, it bypasses through connecting pipes into the bottom of the solution tank, thus mildly agitating the concentrate. The spray booms are mounted approximately 12 inches below the under surface of each wing midway between the front and rear spars and extend from the wing root nearly to its tip. Each spray boom is provided with 52 nozzle outlets, but in work conducted by this Division only 12 equally spaced nozzles have been used on each boom. The nozzles are of the Whirl-Jet type and of the correct orifice to insure delivery of 20 gallons of insecticide concentrate per minute. Concentrates of an abrasive nature should not be dispensed with this type of apparatus because of the damage which would result to the pumps, nozzles, and relief valves.

Concerns who sprayed for this Division under contract used biplanes equipped with twin nozzles mounted close to the tips of the lower wings, multiple-nozzle type metal spray boom with breaker-bar attachment, and rectangular venturi mounted

in the slip stream beneath the fuselage with three nozzles mounted inside the venturi throat. These various types of apparatus effectively dispensed DDT oil concentrates.

II. New York Conservation Department aircraft spraying apparatus

Early in February, the New York State Conservation Department purchased two Stearman PT-17 biplanes through the War Assets Corporation for use in gypsy moth control programs. An unsuccessful attempt was made to purchase dispensing apparatus for installation in this aircraft. It was finally decided to try a very simple installation in one of these biplanes in order to make it available for spraying for at least a part of the control season.

An insecticide tank of approximately 95-gallons capacity was installed in the front cockpit of this biplane. The solution tank was equipped with a 4-inch dump valve, also a short section of pipe of equal diameter extending from the low point in the tank to a point 10 to 12 inches below the bottom of the fuselage for use in quickly dumping the insecticide in case of emergency.

In operation, the insecticide concentrate flows entirely by gravity from the tank through a control valve operated by the pilot to a T connection, where it is divided and passes through 1-inch metal pipes installed inside of each lower wing, to a point near the wing tips. At this point, the pipe line is turned so that it passes through the lower surface of the wing and extends about 10 inches below it. The end of the pipe is cut at a 45° angle.

In the original installation, this dispensing unit depended entirely on the air disturbance created by the forward movement of the biplane to break up and spread the DDT oil concentrate as it flowed from the end of the pipe line. Later, a deflector was attached to the end of the pipe line in such a manner as to cause the concentrate to fan out considerably.

Although this apparatus was rather hurriedly and crudely constructed, its performance was considered reasonably satisfactory.

III. General comments concerning aircraft spraying

An analysis of available data concerning the use of aircraft in spraying more than 62,000 acres of gypsy moth infested woodland with DDT oil concentrates during the 1946 control season

brings to light the following pertinent facts believed of interest, especially to control agencies and private individuals now using or contemplating the use of aircraft in spraying to prevent damage to forest areas by insect pests:

A. The insecticide distributing apparatus should be designed, constructed, and regulated to effectively dispense the required per acre dosage on the area being treated without necessity of recoverage.

B. The time required in ferrying an airplane between a plot being sprayed and the field at which it is serviced remains relatively constant for each plot treated. But, the more gallons of insecticide concentrate carried per trip, the greater the acreage which can be sprayed with each load and during each hour of actual operation. Therefore, in constructing distributing apparatus for use in aircraft, the insecticide tank should be of sufficient capacity to carry the maximum useful load of the airplane into which it is installed. In actual spraying operations, the tank should be filled for each trip with the maximum number of gallons which the pilot decides can be flown and dispensed with safety under the conditions existing in the area at the time of application.

C. To insure success in any control program, especially one involving the use of aircraft as an insecticide dispensing agency, it is imperative that even minor details be carefully worked out and reviewed before the spraying begins. Necessary supplies, materials, and equipment must also be readily available and every person taking part in the program must thoroughly understand and be fully capable of efficient performance of his duties. With carefully laid plans, adequate supplies, and a well organized force nothing is left to chance, except meteorological factors such as wind and fog which greatly hamper the work in some localities.

D. The following statistical data containing information of interest and much value have been compiled from the actual records prepared at service fields from which the airplanes operated during the 1946 control season:

Aircraft	Average Load Per Trip (Gals.)	Inclusive Dates of 1946 Spraying		Spraying and Ferry Between Base & Plots (Hrs. Flown)	1. Days Available Exc. Sat., Sun., Hol. Not Worked	2. Days Weather Permitted Spraying	Acres Treated			Acres Treated Per Hour	Acres Treated Per Day Available (See 1)	Acres Treated Per Day Weather Permitting (See 2)
		From	To				Penna.	N. Y.	Total			
Bureau-owned 45254	57.16	4/8	6/26	100:00	45	40	12,044	1,105	13,149	131.49	292.22	328.72
44868	42.47	"	"	124:00	58	48	11,654	510	12,164	98.09	209.72	253.41
173-H	47.09	4/17	"	81:00	48	29	0	*9,142	9,142	112.85	190.43	315.24
44875	62.85	6/21	"	6:49	4	4	0	1,320	1,320	176.47	340.00	340.00
State-owned N. Y. 605	42.35	6/7	"	36:00	15	14	0	2,965	2,965	82.36	197.66	211.28
Contract A	76.75	6/1	6/24	39:00	20	17	8,290	0	8,290	212.60	414.5	487.64
B	47.00	5/26	6/19	39:50	22	16	5,500	0	5,500	137.5	250.00	343.47
C	41.66	6/3	6/17	21:30	13	10	2,000	0	2,000	93.00	153.84	200.00
**D	56.39	6/6	6/25	62:40	20	15	0	5,245	5,245	83.67	262.25	349.66
#E	40.75	5/27	6/20	25:20	25	20	0	4,320	4,320	170.75	172.80	216.00

* - 1 2/3 gallons of insecticide used on first 1,000 acres sprayed.

** - Apparatus output one-half of others.

- Most acreage at short ferry distance.

In general, the above tabulation corroborates the data presented from "A" through "D" concerning factors governing the amount of acreage which can be treated by an aircraft on an hourly or daily basis. Let us, for a moment, consider the insecticide dispensing equipment used on contract aircraft "D." Contract biplane "D" and the distributing apparatus installed on it were in excellent condition and the pilots were thoroughly qualified to perform their duties. However, because the output of the dispensing apparatus in gallons per minute was only about one-half the quantity necessary for effective treatment of the infested areas, recoverage of all areas sprayed with this biplane was necessary to insure effective results. This extra flying time over the plots treated is reflected in the average of 83.67 acres sprayed per hour of actual operation. This was the second lowest hourly record of all biplanes used in the 1946 gypsy moth control season. On the other hand, this biplane was operated in flat country with growth of even height, was serviced relatively close to the areas being sprayed, and was not handicapped to any extent, at least, by unfavorable air currents. For these reasons, the daily average hours of operation was considerably greater than that of any other airplane engaged in the work and this resulted in a relatively high average daily record of acres effective treated. The acreage treated by this aircraft would have been nearly doubled if the output of the dispensing apparatus had been equal to that of the other machines.

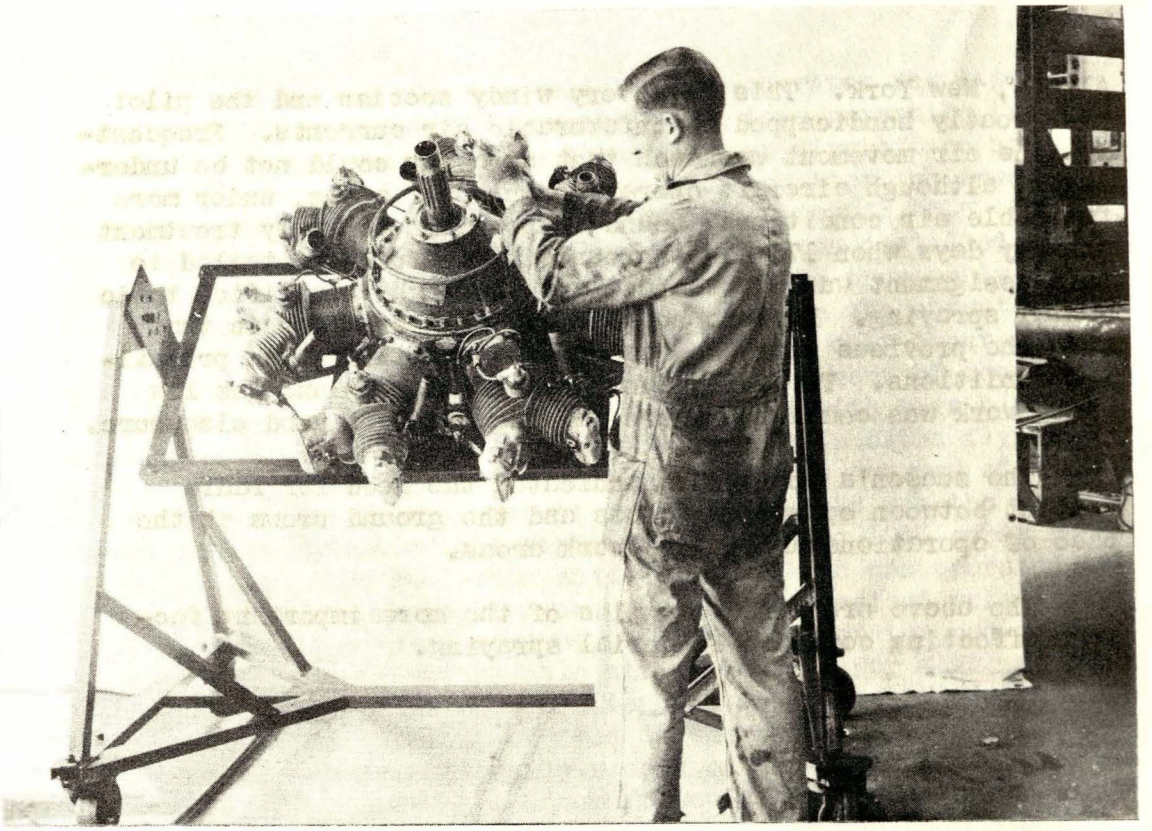
A study of the records of aircraft 45254 and 44868 shows the importance of equipping such planes with tanks capable of holding the maximum amount of insecticide concentrate which can be carried and dispensed with safety. It will be noted that biplane 45254 carrying an average load of 57.16 gallons of insecticide concentrate sprayed a total of 13,149 acres in 100 hours of operation, including the time involved in ferrying the aircraft to and from the servicing field, whereas biplane 44868 carrying an average load of only 42.47 gallons sprayed only 12,164 acres in 124 similar hours of operation. The ferrying distance between the servicing fields and the plots averaged about the same for each biplane for the season as a whole, and both of them were operated by very capable pilots anxious to effectively treat the maximum acreage possible. The only material difference in these biplanes, or the conditions under which they were operated, was the size of the insecticide tank, yet in 24 hours less flying time the biplane carrying the largest average load treated nearly 1,000 acres more of infested forest growth during the control season.

Aircraft 173-H was operated during much of the 1946 control season in the Helderberg Mountain area immediately to the west of

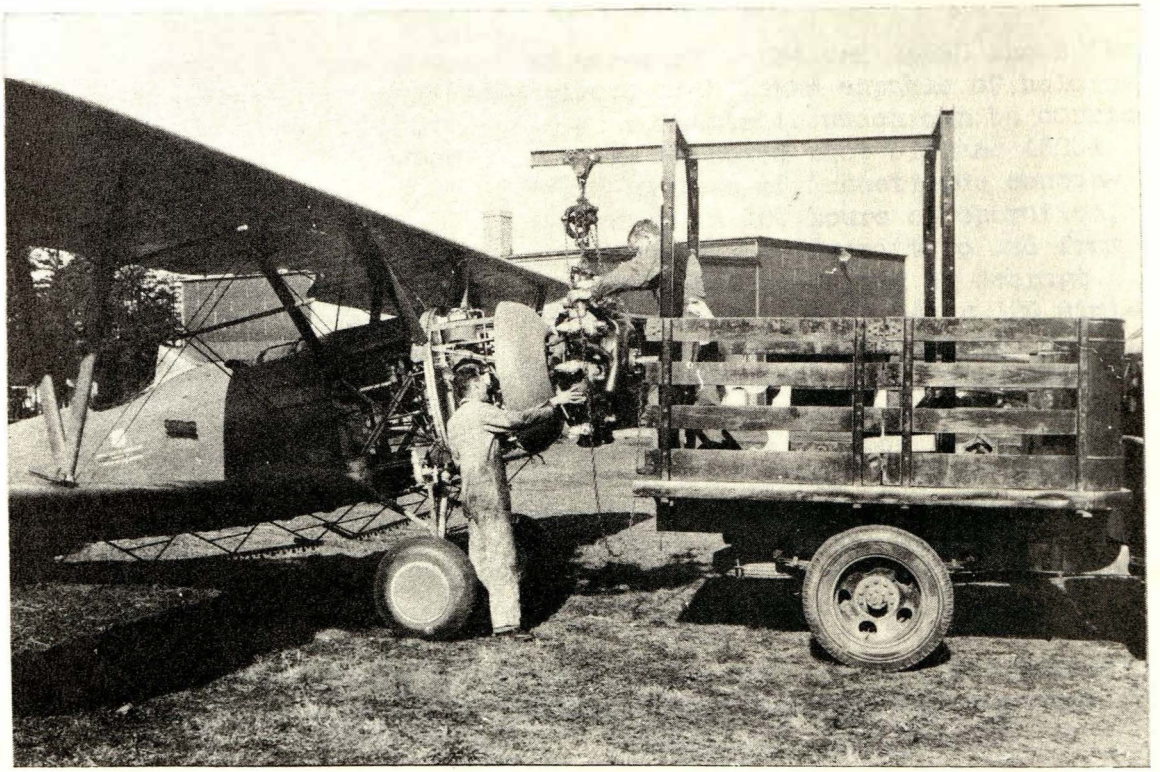
Albany, New York. This is a very windy section and the pilot was greatly handicapped by unfavorable air currents. Frequently, the air movement was such that spraying could not be undertaken, although aircraft operating in other areas, under more favorable air conditions, found it possible to apply treatment on many days when 173-H was grounded. The pilot detailed to this assignment was experienced and thoroughly qualified to do aerial spraying. Because he had done some spraying in that area the previous year, he was somewhat familiar with prevailing conditions. The daily average for this biplane was low until work was completed there and the aircraft used elsewhere.

The season's operations indicated the need for radio contact between operating pilots and the ground crews at the base of operations and in the work areas.

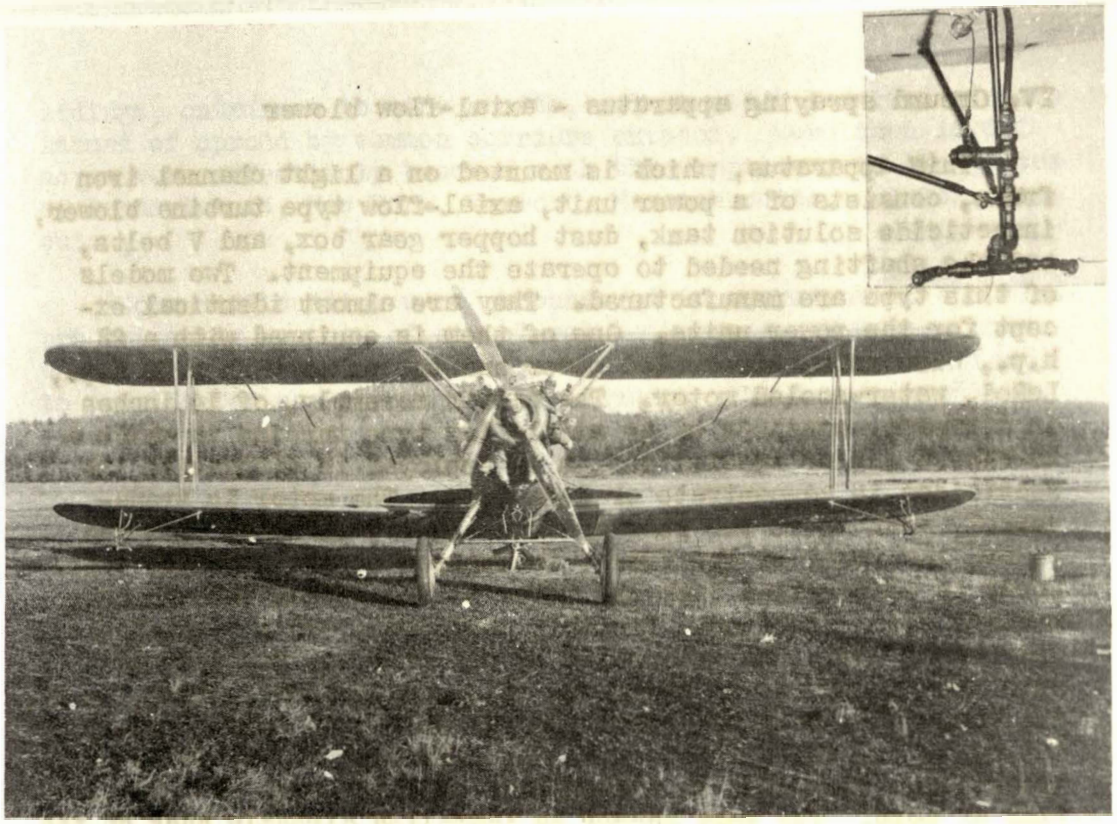
The above are a few examples of the more important factors affecting coverage in aerial spraying.



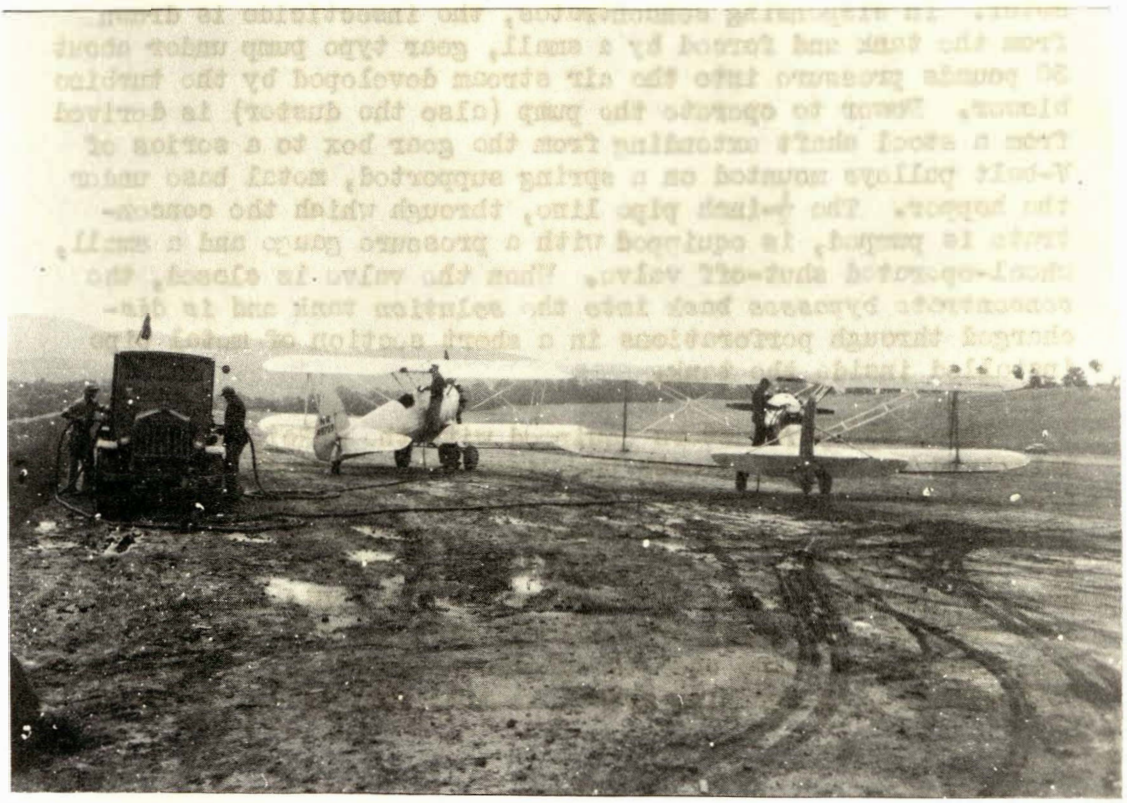
SHOP CONSTRUCTED STANDARD FOR HOLDING AIRPLANE ENGINE DURING OVERHAUL. 1946.



SHOP CONSTRUCTED HOIST MOUNTED ON TRUCK USED IN REMOVING AND INSTALLING AIRPLANE ENGINES. 1946.



N3N-3 BIPLANE EQUIPPED WITH TWIN NOZZLE TYPE INSECTICIDE DISPERSING APPARATUS. NOZZLES ARE LOCATED NEAR ENDS AND JUST BELOW THE LOWER WING. INSERT SHOWS NOZZLE ASSEMBLY. 1946



HIGH-POWER SPRAYER USED FOR MIXING AND HEATING DDT OIL CONCENTRATE. MATERIAL IS PUMPED FROM THE SPRAYER TO THE INSECTICIDE TANKS IN THE BIPLANES. 1946

IV. Ground spraying apparatus - axial-flow blower

This apparatus, which is mounted on a light channel iron frame, consists of a power unit, axial-flow type turbine blower, insecticide solution tank, dust hopper gear box, and V belts, and the shafting needed to operate the equipment. Two models of this type are manufactured. They are almost identical except for the power units. One of them is equipped with a 22 h.p., Wisconsin, air-cooled motor and the other with a 30 h.p., LeRoi, water-cooled motor. The blower assembly, of 14 inches in diameter, consists of an axial-flow type turbine in which a 25-bladed fan of special design is employed in dispensing insecticides in concentrate or dust form. The motor is transversely mounted at the rear and the blower, parallel with and toward the front of the frame, is mounted on the opposite side. Power is transmitted from the motor to the blower through connecting steel shaftings, flexible couplings, and a right-angle drive gear box. The gear ratio of the gear box assembly is such that in operating the motor at approximately 2,000 r. p. m., the air movement at the blower nozzle throat is approximately 150 m. p. h., which is adequate for effective distribution of insecticide dispensed in concentrate or dust form, or a combination of both. The dust hopper is installed directly back of the blower and the insecticide solution tank of about 50-gallons capacity is mounted parallel to the blower just forward of the motor. In dispensing concentrates, the insecticide is drawn from the tank and forced by a small, gear type pump under about 30 pounds pressure into the air stream developed by the turbine blower. Power to operate the pump (also the duster) is derived from a steel shaft extending from the gear box to a series of V-belt pulleys mounted on a spring supported, metal base under the hopper. The $\frac{1}{2}$-inch pipe line, through which the concentrate is pumped, is equipped with a pressure gauge and a small, wheel-operated shut-off valve. When the valve is closed, the concentrate bypasses back into the solution tank and is discharged through perforations in a short section of metal pipe installed inside the tank.

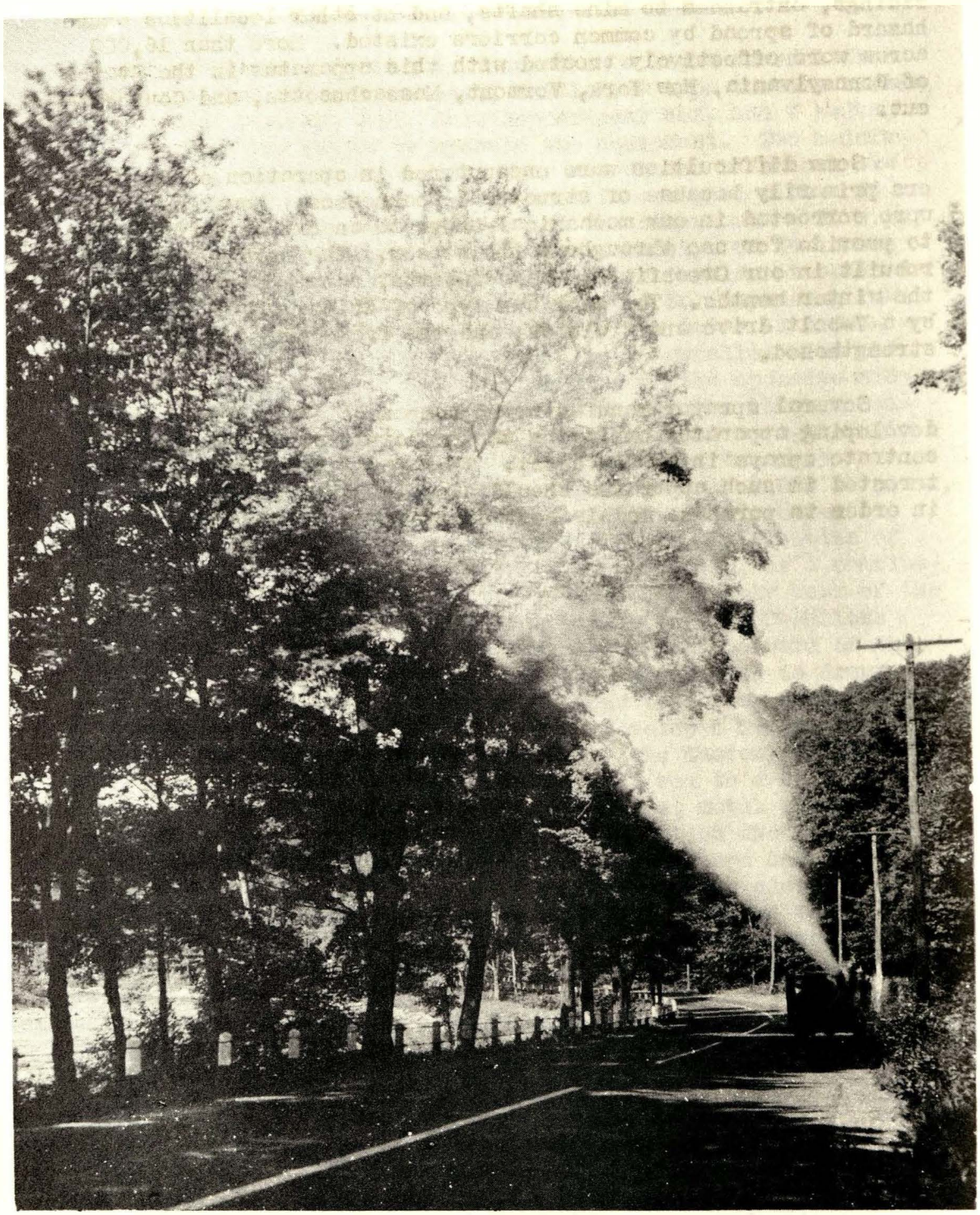
Three sprayer-dusters equipped with the LeRoi, water-cooled motor and one equipped with the Wisconsin, air-cooled motor were procured by this Division. These blowers, together with one purchased by the Pennsylvania State Department of Agriculture and one procured by the New York State Conservation Department, were used in spraying growth along roadsides, in residential areas, in open country, and edges of woodland infested with the gypsy moth. The blowers were also used to excellent advantage, especially in Pennsylvania, in spraying growth at mine collieries, railroad

sidings, entrances to mine shafts, and at other localities where hazard of spread by common carriers existed. More than 16,000 acres were effectively treated with this apparatus in the States of Pennsylvania, New York, Vermont, Massachusetts, and Connecticut.

Some difficulties were encountered in operation of the blowers primarily because of structural weaknesses. However, these were corrected in our mechanical shops to an extent sufficient to provide for use throughout the season. The machines will be rebuilt in our Greenfield, Massachusetts, repair shop during the winter months. The gear box type of drive will be replaced by a V-belt drive and a clutch, and the framework will be strengthened.

Several sprayer manufacturing companies are reported to be developing apparatus employing the principle of dispensing concentrate sprays in an air blast. Therefore, those who are interested in such apparatus should closely watch developments in order to purchase models best adapted for their needs.

* * *



SPRAYING ROADSIDE TREES WITH DDT OIL CONCENTRATE USING TURBINE BLOWER. 1946

SUGGESTIONS FOR THE USE OF DDT

The following statement issued on April 1, 1946, is incorporated in this report since it was very helpful and stimulated much interest in the proper use of DDT and resulted in better control of the gypsy moth and several other insect pests at a greatly reduced cost.

The formulae given under Oil Solutions were used extensively with entirely satisfactory results. Several reports were received stating that in many cases poor results were obtained when the 1 pound formula for emulsion spray was used with the conventional, high-powered, ground sprayers. These reports indicated that 3 pounds of DDT per acre resulted in much better control.

At the annual meeting of the Massachusetts Tree Wardens' and Foresters' Association held in Boston, February 14, 1946, an entire afternoon was given to reports of results of the use of DDT as an insecticide. Talks were followed by an enthusiastic question period at which time a request was made that a statement be prepared and circulated to the membership to aid them in the safe and proper use of this new insecticide for controlling the gypsy moth and orchard insects. Accordingly, the speakers at the meeting, Dr. F. C. Bishopp, Messrs. R. C. Brown and S. S. Crossman, representing the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture have, with Commissioner A. K. Sloper of the Massachusetts Conservation Department, prepared Part I of this statement and Dr. W. D. Whitcomb of the Massachusetts Agricultural Experiment Station prepared Part II.

Part I
For Control of Gypsy Moth and Other Forest and Shade Tree Insects

An enormous amount of research work has been done to determine the best use of DDT and its effects on animal and plant life. Many factors have been considered and although much work remains to be done, there is now sufficient information so that DDT may be recommended for general use for the control of many injurious insects of forest and shade trees.

DDT is an extremely valuable insecticide but it is not a cure-all. It is very effective against many insects, including flies, mosquitoes, bedbugs, lice on man and animals, leafhoppers, Japanese beetle, potato beetles, white pine weevil, elm leaf beetle, bark beetle, Eastern and forest tent caterpillars, fall webworm, cankerworms, striped oak worm, striped maple worm, spruce budworm, gypsy moth and brown-tail moth. It has not been effective with the formulation used against such insects as the cotton boll weevil, European red mite, common red spider, plum curculio, pear psylla, some scale insects, some plant lice, Mexican bean beetle, 17-year locust, European pine shoot moth and birch leaf miner.

The extreme alarm with regard to the killing of all beneficial insects, wildlife, birds, fish and bees over large areas and the poisoning of warm-blooded arnimals, including man, has been alleviated to a considerable degree by subsequent research work. In some instances trouble from plant infesting mites has been intensified following the use of DDT.

It is poisonous to man and other warm-blooded animals but less so than are many of the insecticides such as lead, arsenic, nicotine, and fluorine which have been used abundantly for many years.

DDT has been injurious to wildlife, including birds and fish, when used in excessive amounts. Where 5 pounds per acre were used in woodlands some dead birds were found and most insectivorous species of birds left the area for several weeks. No mortality of birds was noted where one and two pounds per acre were used. Aquatic life is more seriously affected than terrestrial and arboreal forms. Some mortality of fish may be expected with a 1 pound per acre dosage and harm can be done with dosages of 1/2 to 1 pound of DDT per acre. Experiments have shown that most forest insects can be controlled with dosages of 1 pound of DDT per acre or less; in fact, excellent results have been obtained for gypsy moth control when as little as 1/2 or even 1/4 pound per acre were used. No appreciable injury to the foliage of forest or shade trees resulted from the use of DDT at rates up to 5 pounds in 5 gallons of oil per acre when applied by aircraft and ground blowers but some burning of foliage has resulted where relatively high concentrations of DDT have been applied with knapsack

sprayers. Burning probably was due to an excessive application of oil. Most crop plants have not been injured although a few, such as squash, cucumbers, melons and tomatoes, are susceptible to damage.

Many kinds of beneficial insects are killed by DDT when applied at rates as low as 1/8 pound per acre but even when it has been used at the rate of 5 pounds per acre the areas have in time been repopulated by infiltration. At the lower rates, repopulation occurs within a few days and it appears to take place somewhat in relation to the dosage used.

Experiments indicate that DDT in the concentrations likely to be used against forest insects is considerably less toxic to honey bees than are arsenicals. Some losses occur among bees that are flying during the application but such losses have not been serious and could be avoided by closing or moving hives during the short period of application. DDT sprays, as is the case with other poisonous insecticides, should not be applied on favored trees such as basswood, tulip, locust, or fruit trees during the blooming period.

Apparatus - Several types of insecticide distributing apparatus have been developed and attached to aircraft for spraying woodlands. Experimental work last summer indicated the possible use of helicopters for such work since they are very maneuverable but the type used was not made for such use and its payload was small. More useful, at present, are biplanes such as the White Standard, Navy N3N-3, and Stearman. These are maneuverable, sturdy planes and carry from 60 to 100 gallons of spray material. They can be flown safely over forests at relatively slow speed, about 80 miles per hour. A gravity-fed spinner disc type of insecticide distributing apparatus consisting of two units, one at each end of a cross boom, through which the insecticide flows to the units is very satisfactory. Equally effective and more easily constructed, is an apparatus consisting of a spray boom with a series of nozzles. Another type ready for trial has a single nozzle near each end of the lower wing. The insecticide is forced into the nozzles by a gear type pump, deriving its power from a propeller-type windmill revolved by the forward speed of the airplane. When these planes are flown about 50 feet above the treetops at 80 miles per hour, the insecticide is distributed over a swath of about 120 feet.

A new method for applying insecticides from the ground has been developed. Equipment has been made for finely atomizing the spray and introducing it into the air-blast of power blowers. Very small volumes of highly concentrated DDT spray may be distributed with this type of equipment. Solutions, emulsions and suspensions of DDT and other insecticides may be dispersed by using specially designed nozzles.

A new mist-blower, known as an axial-flow type turbine blower using the principle of air velocity for the distribution of concentrated sprays, was used with great promise during the past summer. It is especially adaptable for treating shade and ornamental trees in residential areas as well as those along wood edges. It is so constructed that a directional rather than a turbulent air current is obtained, resulting in carrying the insecticide well over the tops of tall trees and into the woodlands to distances of 25 feet against a 15 mile per hour wind and 350 to 400 feet during calm. At these distances, complete control of the gypsy moth was obtained. Considerable killing of caterpillars was observed in woodland 1,000 feet from the roadside when a slight breeze was blowing in the same direction. Two other types of high-powered blowers for dispersing concentrated sprays in finely atomized form also were used effectively.

It is expected that many improvements will be made in these machines in the near future.

High-powered ground sprayers which have been used for many years on gypsy moth control work can be used for applying DDT as emulsions or suspensions but the capacity of such equipment is much less than the air-blown type and the cost of operation is considerably greater. In using this type of equipment with DDT, emphasis must be placed on light dosage. Be sure no more than 1 pound of DDT, for instance, is put in 500 or 600 gallons of water and then spray an acre with that amount of liquid.

Knapsack and small hand mist apparatus can be used to great advantage for treating small areas where the tree growth is not more than 25 feet in height. They will be especially useful in back yards, around dumps, along fence rows, and stonewalls, especially when DDT is applied in an oil solution before hatching of the gypsy moth eggs.

Formulations - DDT can be used as dusts or powders, oil solutions, emulsions and as water dispersable powders. Commercial preparations are now available and are the most satisfactory except for large or commercial operators. The amount of DDT in them varies greatly and the directions on the containers should be followed closely. Technical grade DDT is not suitable for use as a powdered insecticide without processing and it is rather difficult to prepare with diluents in powder form. Its use by the Bureau of Entomology and Plant Quarantine for forest insect control has been as oil solutions, emulsions and suspensions. The latter two offer promise but most of the work with gypsy moths and other forest insects has been done with the oil solutions.

Oil Solutions

DDT - 1 pound
Kerosene or No. 2 Fuel oil - 1-2/3 gallons

This formula can be used with aircraft, mist blowers, and knapsack sprayers previous to hatching and throughout the caterpillar season. However, after hatching the following weaker solution can be used:

DDT - 7 ounces
Kerosene or No. 2 Fuel oil - 1 gallon

The DDT will not dissolve readily in the oil unless stirred vigorously at a temperature of 70° F. or somewhat higher. The use of an auxiliary solvent such as xylene (Tech. Grade) or Velsicol AR 50 helps dissolve the insecticide, and also helps to hold it in solution. A formula follows:

DDT - 1 pound
Xylene - 1 quart or Velsicol AR 50 - 2-1/2 pints
Kerosene or No. 2 Fuel Oil to make 1 gallon

The same formula using two gallons of kerosene or No. 2 fuel oil instead of one is also satisfactory for use in knapsack and hand mist sprayers.

In many cases, good control has been obtained when the oil solutions were applied before hatching by merely treating the tree trunks, lower limbs, forest debris and stonewalls harboring egg clusters.

Emulsions - For use in high-powered ground sprayers

DDT - 1 pound
Xylene - 1 quart or Velsicol AR 50 - 2-1/2 pints
Igepal CA Extra - 1/5 pint
Water - A few quarts for preliminary mixing

This should be diluted according to dosage required. For instance if 1 pound DDT is desired per acre, pour it into enough water (500 to 600 gallons) to spray the acre. Add while water in spray tank is agitated.

Any of these formulations can be used for gypsy moth control and the spraying can be started two or three weeks before hatching but the stronger solutions are recommended for the earliest spraying.

Part II
For Control of Orchard Insects

DDT has given excellent control of the codling moth and the white apple leafhopper on apples; the Oriental fruit moth, the Japanese beetle and the tarnished plant bug on peaches; the rose chafer and the grape leafhopper on grapes and the pear thrips on pears. On the other hand, it has been relatively ineffective against the plum curculio, European red mite and apple maggot on apples, and the pear psylla on pears as well as scale insects on all fruit trees. Strangely enough, the insects which have not been well controlled with DDT are among the most destructive pests of fruit in Massachusetts. Therefore, the use of this insecticide for fruit pest control in this area is generally limited to special treatments for codling moth control on apples and Oriental fruit moth and Japanese beetle control on peaches.

The preferred DDT formulations to use in standard equipment for fruit tree spraying is wettable powder at the rate of 1 pound of actual DDT in 100 gallons of water. Wettable powder generally will contain 25%, 40% or 50% DDT, and is used at the rate of 4, 2-1/2 or 2 pounds respectively in 100 gallons to supply the required concentration. All other common insecticides or fungicides

except those containing lime or other strong alkali can be added to DDT to provide a combination spray. DDT is also available in a 3% or 5% dust, and this can be combined with sulfur very effectively.

An informal tolerance on DDT residue on fruit and vegetables has been recommended at 7 parts per million. This is the same tolerance which has been placed on lead residue, and twice the amount of arsenic residue which is permitted. If this tolerance is made official and is enforced, fruit growers in Massachusetts should have no more difficulty in meeting the requirements than they now have where using lead arsenate.

More specific suggestions for use on fruit are:

APPLES

Codling Moth - Wettable powder at the rate of 1 pound DDT in 100 gallons of water. It should be limited to three applications per season. These applications should be concentrated against the first brood of codling moth, and made according to the standard spray schedule at the 2d cover period and 10-14 days later. If injury by the second brood of the codling moth threatens, a third application of DDT at the 4th cover period, or about August 1, is advised. Do not apply before the 1st cover period when bees and other pollinating insects will be killed more easily.

European red mite and possibly apple aphids may be expected to increase after spraying with DDT, but DN-111 at the rate of 1 pound in 100 gallons, or nicotine sulfate 1 pint in 100 gallons, can be added to any application of DDT.

DDT gives excellent control of the white apple leafhopper and one application in mid-summer should give control for the remainder of the season. If a special application for leafhopper is made, a spray containing 1/2 pound of DDT in 100 gallons, or a 3% DDT dust should be effective.

PEACHES

Oriental Fruit Moth - Wettable powder as for apples, or DDT-talc dust containing 3% or 5% DDT, preferably combined with sulfur. Until further information is available, it should be limited to 2 or 3 applications at 10 day intervals beginning in mid-July. This treatment should give a reasonable control of the worms and should reduce the moth population to a minimum. An application after the "shuck" stage when the young fruit is about marble size should give good control of cat-facing by tarnished plant bug.

PEARS

Pear Psylla - Preliminary reports indicate poor control of pear psylla with DDT sprays and their use on pears does not seem practical.

CAUTION

DDT is a poison and it should be stored and handled with the precautions usual with all poisonous insecticides.

Directions accompanying commercial preparations should be accurately followed.

DDT in oil solutions or emulsions is readily absorbed through the skin of man and animals and persons should avoid repeated or prolonged exposures to it.

Avoid contamination of food stuffs.

Do not spray directly over streams or ponds.

Do not mix large quantities of oil solutions for future use since in temperatures much below 70° the DDT will crystallize out, resulting in weakening the application and in plugging the nozzles.

Do not overspray. Only a very small amount is needed to be effective.

DDT in oil solution should not be used indoors near fires.

Please feel free to write or visit the State Conservation Department in Boston, or the Bureau of Entomology and Plant Quarantine offices at New Haven, Connecticut and Greenfield, Massachusetts, for further information pertaining to gypsy moth control work. The New Haven office will be glad to furnish information on the control of other forest and shade tree insects. Further information relating to orchard spraying can be obtained from the Massachusetts Agricultural Experiment Station at Cedar Hill, Waltham, Massachusetts.

* * *

DEFOLIATION CAUSED BY THE GYPSY MOTH LARVAE

Extensive defoliation of forest and shade trees occurred again during the summer of 1946, when approximately 623 thousand acres of woodland were recorded from 25 to 100 per cent defoliated. Although this is 2 hundred thousand acres less than during the year 1945, when defoliation occurred more extensively than ever before, it is the second greatest acreage ever recorded.

These records were obtained by cooperating State forces and were supplemented, especially in the Connecticut River Valley towns of Massachusetts, with observations made by members of this Division. A detailed, statistical report has been prepared and distributed to cooperators.

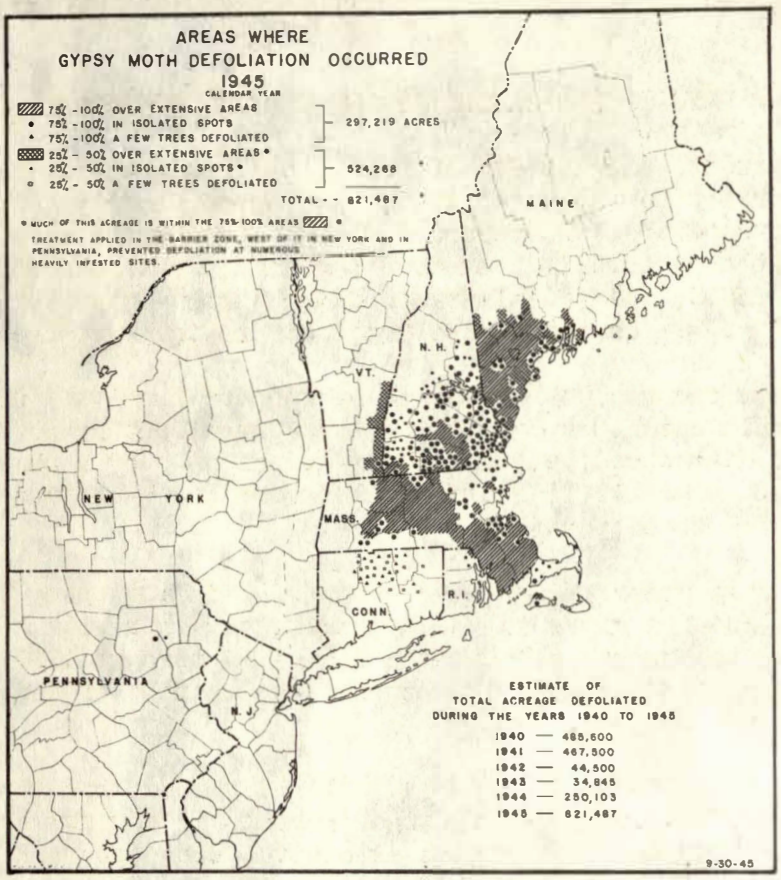
A table summarizing the records of defoliation by States for 1945 and 1946 is given in the Appendix, together with a tabulated record of the annual defoliation from 1924 through 1946. The accompanying maps indicate the extent and location of defoliation for the last two seasons.

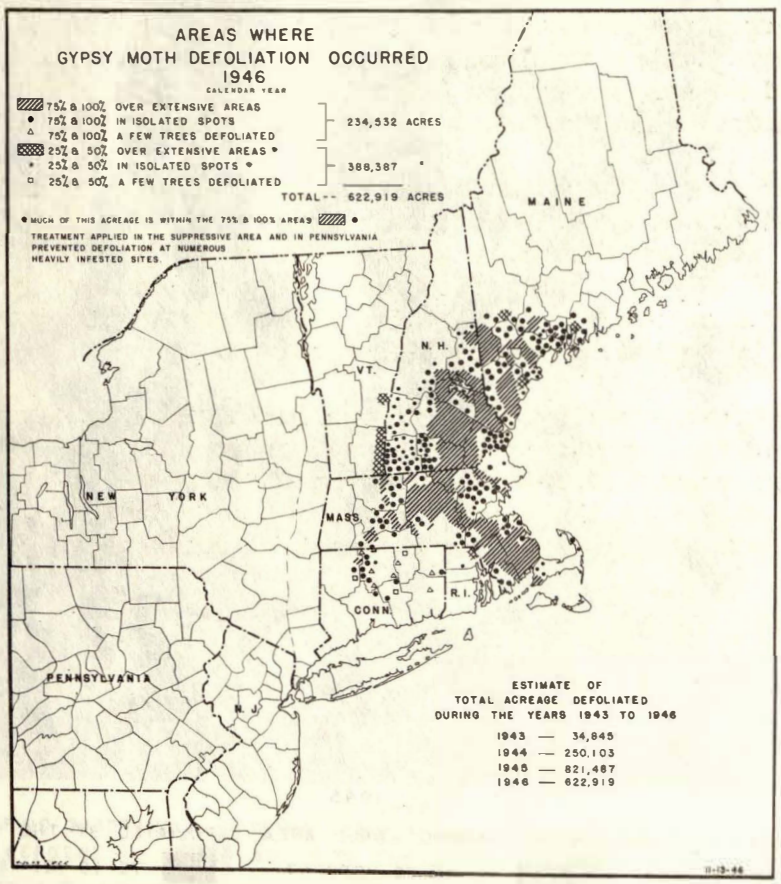
The defoliation in Maine was slightly less than for the previous year, but there was a large increase in New Hampshire. In Massachusetts, defoliation was extensive, although much less than in 1945, and it is interesting to note that no serious defoliation has occurred for two seasons east of the Cape Cod Canal. In Vermont, there was no complete defoliation recorded. The defoliation increased to some extent in Rhode Island and Connecticut, but no severe defoliation over extensive areas occurred in either State.

There was a large reduction in the extent and degree of defoliation in the Quabbin Reservoir area in western Massachusetts, where in 1945 approximately 90 per cent of the woodland area was from 25 to 100 per cent defoliated. Only 22 per cent of the same area showed noticeable defoliation this season. The difference is shown in the accompanying illustrations.

The practicability of surveying large areas by aircraft to record defoliation was tried this summer in a limited way. Results were promising and with further refinements it may be possible to record the higher degrees of defoliation more accurately and at a greatly reduced cost by using this method.

* * *


AREAS WHERE
GYPSY MOTH DEFOLIATION OCCURRED
1945
CALENDAR YEAR
75% - 100% OVER EXTENSIVE AREAS
75% - 100% IN ISOLATED SPOTS
75% - 100% A FEW TREES DEFOLIATED
297,219 ACRES
25% - 50% OVER EXTENSIVE AREAS *
25% - 50% IN ISOLATED SPOTS *
25% - 50% A FEW TREES DEFOLIATED
524,268
TOTAL - - 821,487
* MUCH OF THIS ACREAGE IS WITHIN THE 75%-100% AREAS
TREATMENT APPLIED IN THE BARRIER ZONE, WEST OF IT IN NEW YORK AND IN PENNSYLVANIA, PREVENTED DEFOLIATION AT NUMEROUS HEAVILY INFESTED SITES.
MAINE
N. H.
VT.
NEW YORK
MASS.
R.I.
CONN.
PENNSYLVANIA
N. J.
ESTIMATE OF
TOTAL ACREAGE DEFOLIATED
DURING THE YEARS 1940 TO 1945
1940 — 485,600
1941 — 467,500
1942 — 44,500
1943 — 34,845
1944 — 250,103
1945 — 821,487
9-30-45

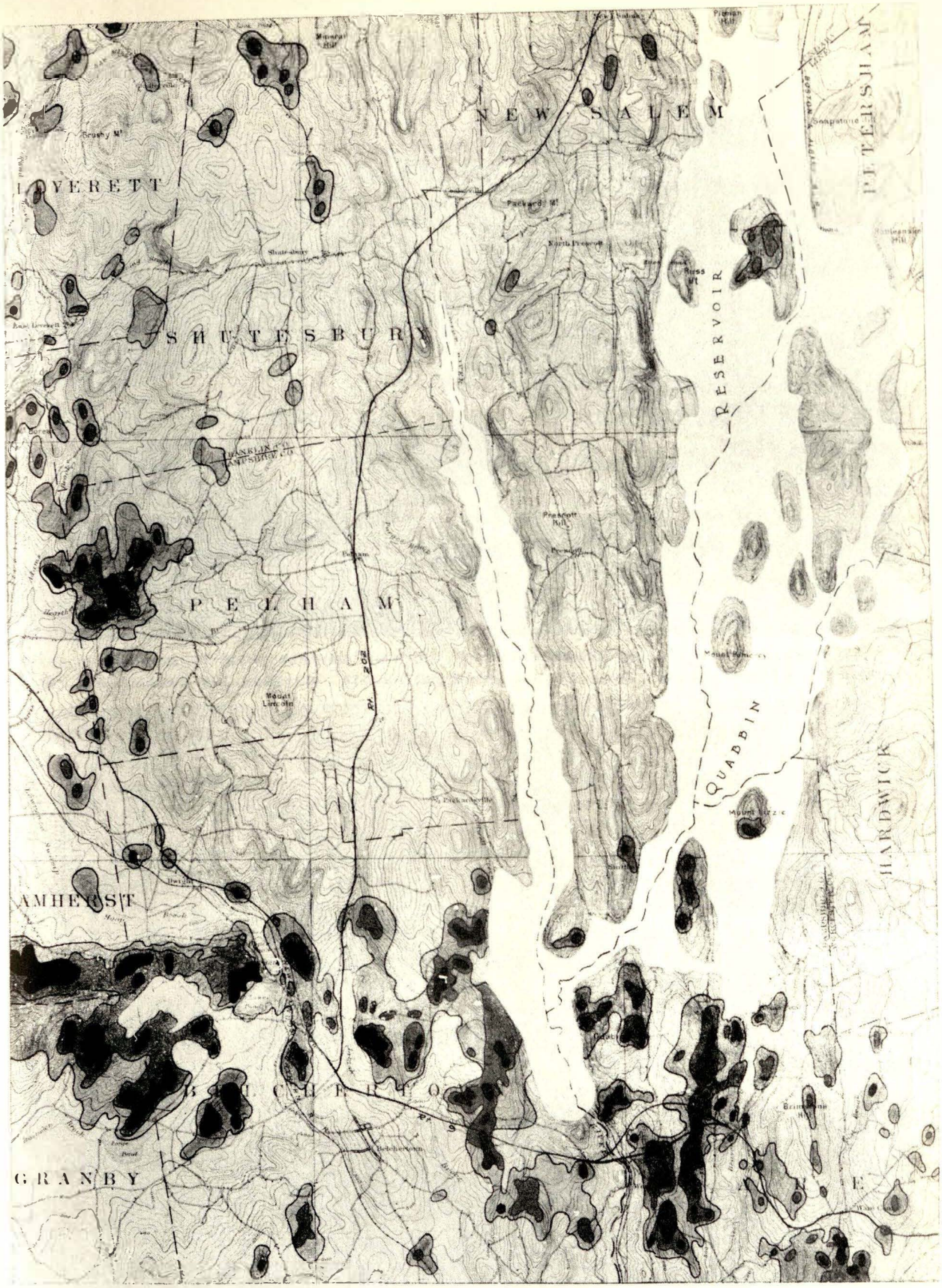

AREAS WHERE
GYPSY MOTH DEFOLIATION OCCURRED
1946
CALENDAR YEAR
75% & 100% OVER EXTENSIVE AREAS
75% & 100% IN ISOLATED SPOTS
75% & 100% A FEW TREES DEFOLIATED
234,532 ACRES
25% & 50% OVER EXTENSIVE AREAS *
25% & 50% IN ISOLATED SPOTS *
25% & 50% A FEW TREES DEFOLIATED
388,387
TOTAL-- 622,919 ACRES
* MUCH OF THIS ACREAGE IS WITHIN THE 75% & 100% AREAS
TREATMENT APPLIED IN THE SUPPRESSIVE AREA AND IN PENNSYLVANIA PREVENTED DEFOLIATION AT NUMEROUS HEAVILY INFESTED SITES.
MAINE
N. H.
VT.
NEW YORK
MASS.
R.I.
CONN.
PENNSYLVANIA
N. J.
ESTIMATE OF
TOTAL ACREAGE DEFOLIATED
DURING THE YEARS 1943 TO 1946
1943 — 34,845
1944 — 250,103
1945 — 821,487
1946 — 622,919
11-13-46

1945

TYPICAL TOPOGRAPHIC QUADRANGLE SHOWING LARGE AREA DEFOLIATED BY THE GYPSY MOTH

25 TO 50 PERCENT 50 TO 75 PERCENT 75 TO 100 PERCENT

THIS SURVEY DOES NOT INCLUDE TOWNS OF PETERSHAM AND HARDWICK.

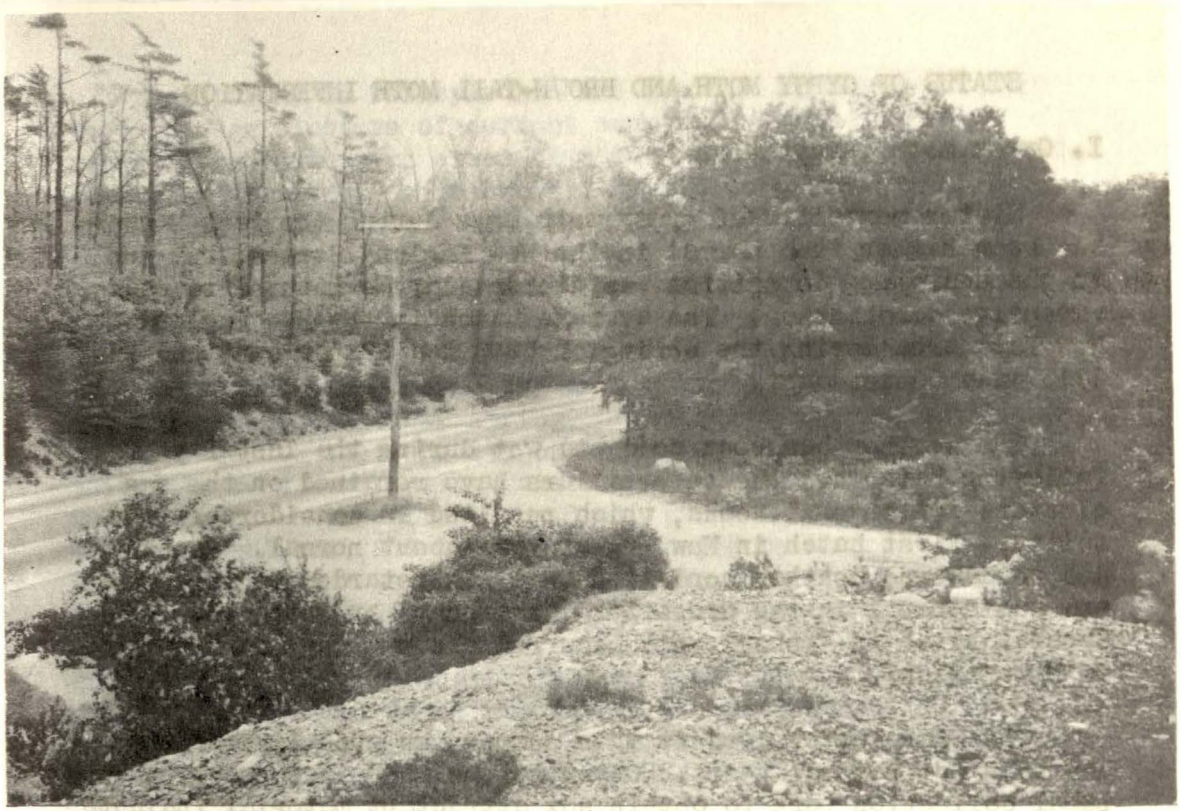


1946

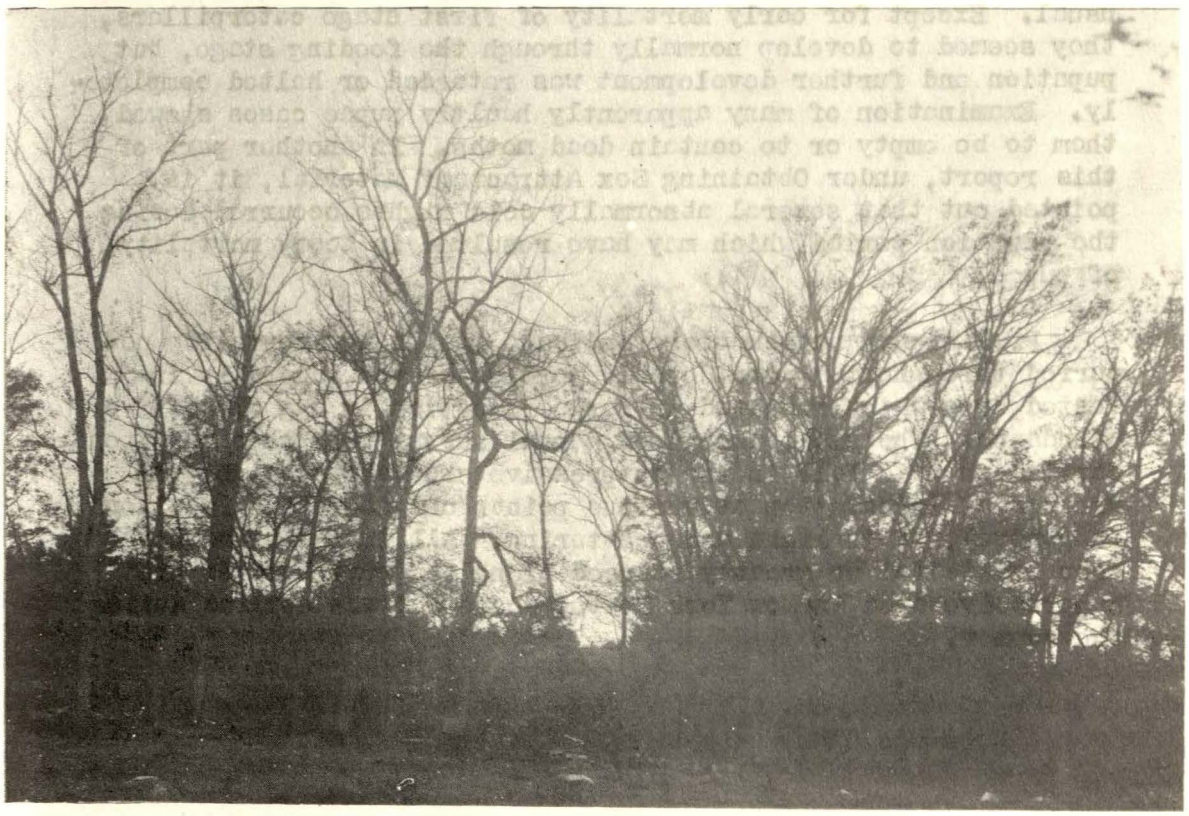
TYPICAL TOPOGRAPHIC QUADRANGLE SHOWING LARGE REDUCTION IN AREA DEFOLIATED BY THE GYPSY MOTH.

25 TO 50 PERCENT 50 TO 75 PERCENT 75 TO 100 PERCENT

THIS SURVEY DOES NOT INCLUDE TOWNS OF PETERSHAM AND HARDWICK. 1946



TREES ON ROADSIDE AT RIGHT SPRAYED WITH DOT OIL CONCENTRATE USING TURBINE BLOWER. TREES ACROSS ROAD NOT SPRAYED. STOUGHTON, MASS. JULY 10, 1946. SPRAY APPLIED MAY 29, 1946



DEFOLIATION OF LARGE WHITE OAKS BY THE GYPSY MOTH. WESTFIELD, MASS. AUGUST 1946.

STATUS OF GYPSY MOTH AND BROWN-TAIL MOTH INFESTATION

I. Gypsy moth infestation

Winter mortality of gypsy moth eggs during the last 2 years has been higher than normal in the New England States, but due to the heavy egg deposition, sufficient larvae matured to cause extensive defoliation. The average hatch in the New England-New York area during the spring of 1946 was 67 per cent and in 1945 only 65 per cent.

The weather has been cold and wet during the last 2 years following hatch and the caterpillars have remained on the egg clusters for several weeks, which resulted in considerable mortality. First hatch in New England was about normal. However, due to adverse weather conditions, it was retarded about a week and was general in the Greenfield area about May 15 to 18. General hatch in Pennsylvania occurred about a week earlier than in New England.

The egg cluster deposit this summer was much lighter than it had been for several years. Observations made in connection with pupal collection work to obtain sex attractant material indicate slightly more pupal parasitism than in recent years. However, the wilt disease and predators did not appear more abundant than usual. Except for early mortality of first stage caterpillars, they seemed to develop normally through the feeding stage, but pupation and further development was retarded or halted completely. Examination of many apparently healthy pupae cases showed them to be empty or to contain dead moths. In another part of this report, under Obtaining Sex Attractant Material, it is pointed out that several abnormally cold nights occurred during the pupation period which may have resulted in heavy mortality of pupae.

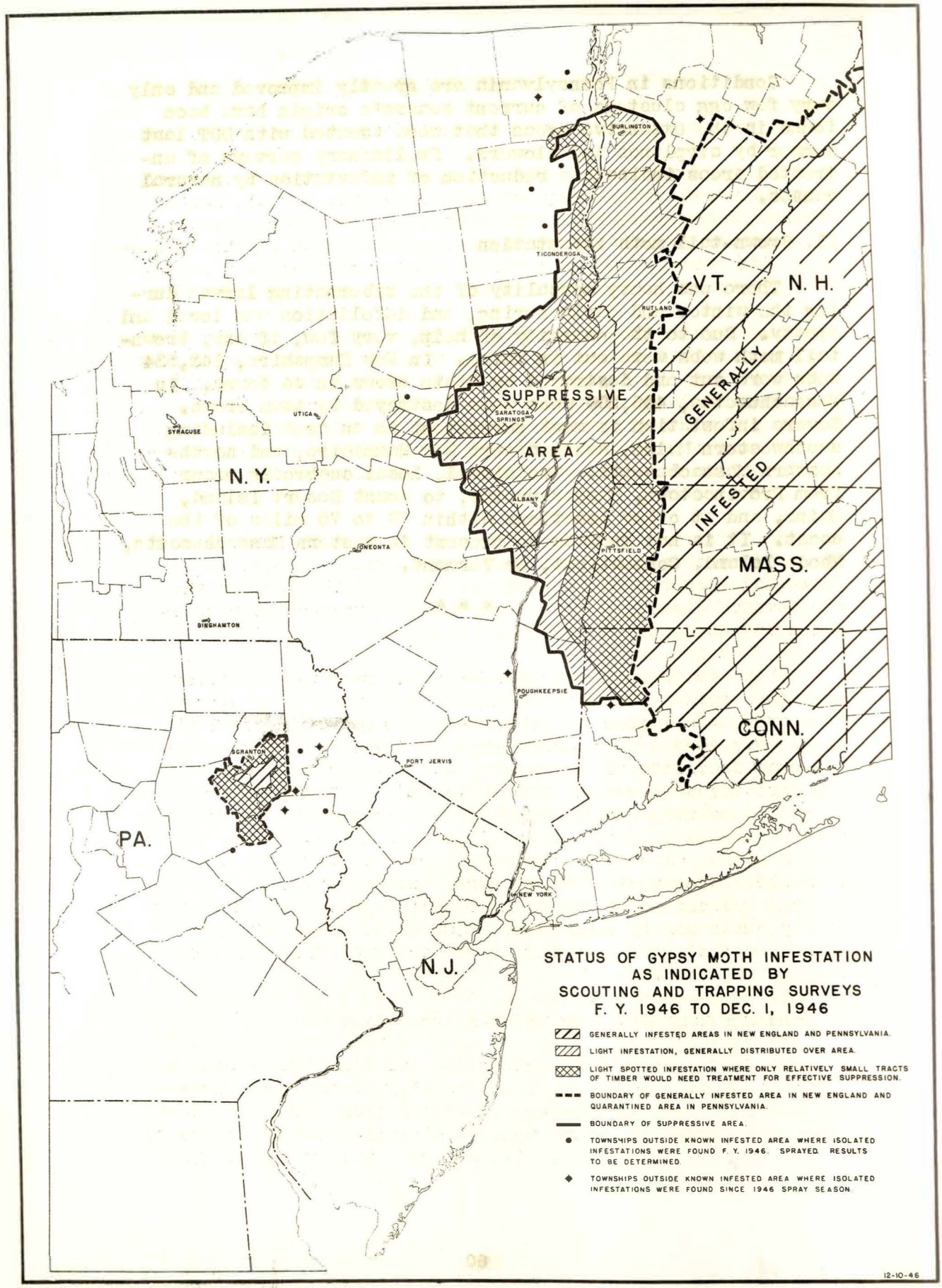
Preliminary examinations indicate that heavy mortality occurred throughout a considerable portion of the generally infested area which resulted in large reduction in egg cluster abundance. The small amount of manual survey work that has been carried on this fall in the suppressive area shows slight increases of infestation at various points and decreases in others. In general, it is light and scattering. All infestations have been eradicated or greatly reduced along the periphery of the suppressive area in New York State, where DDT was applied during the summer.

Conditions in Pennsylvania are greatly improved and only very few egg clusters of current season's origin have been found in the extensive areas that were treated with DDT last summer by airplanes and blowers. Preliminary surveys of untreated areas indicate a reduction of infestation by natural causes.

II. Brown-tail moth infestation

There was heavy mortality of the hibernating larvae during the winter and early spring, and defoliation was local and spotty. Due to the scarcity of help, very few, if any, brown-tail moth webs were cut in Maine. In New Hampshire, 142,534 webs were cut and destroyed by State crews in 44 towns. In Massachusetts, 446,200 webs were destroyed by town crews. Severe infestation is most persistent in an area including southwestern Maine, southeastern New Hampshire, and northeastern Massachusetts. Occasional, local outbreaks occur from Provincetown, Massachusetts, to Mount Desert Island, Maine, and at other locations within 50 to 75 miles of the coast. It is not known to be present in western Massachusetts, Rhode Island, Connecticut, or Vermont.

* * *


BURLINGTON
TICONDEROGA
VT.
N. H.
RUTLAND
SUPPRESSIVE
AREA
GENERALLY
INFESTED
SARATOGA SPRINGS
UTICA
SYRACUSE
N. Y.
ALBANY
ONEONTA
PITTSFIELD
MASS.
BINGHAMTON
POUGHKEEPSIE
CONN.
SCRANTON
PORT JERVIS
PA.
NEW YORK
N. J.
STATUS OF GYPSY MOTH INFESTATION
AS INDICATED BY
SCOUTING AND TRAPPING SURVEYS
F. Y. 1946 TO DEC. 1, 1946
GENERALLY INFESTED AREAS IN NEW ENGLAND AND PENNSYLVANIA.
LIGHT INFESTATION, GENERALLY DISTRIBUTED OVER AREA.
LIGHT SPOTTED INFESTATION WHERE ONLY RELATIVELY SMALL TRACTS OF TIMBER WOULD NEED TREATMENT FOR EFFECTIVE SUPPRESSION.
BOUNDARY OF GENERALLY INFESTED AREA IN NEW ENGLAND AND QUARANTINED AREA IN PENNSYLVANIA.
BOUNDARY OF SUPPRESSIVE AREA.
TOWNSHIPS OUTSIDE KNOWN INFESTED AREA WHERE ISOLATED INFESTATIONS WERE FOUND F. Y. 1946. SPRAYED. RESULTS TO BE DETERMINED.
TOWNSHIPS OUTSIDE KNOWN INFESTED AREA WHERE ISOLATED INFESTATIONS WERE FOUND SINCE 1946 SPRAY SEASON.
12-10-46

I. Federal Gypsy Moth and Brown-tail Moth Quarantine No. 45

This quarantine is enforced by the Division of Japanese Beetle Control with headquarters at 503 Main Street, East Orange, New Jersey, with a substation at 144 Moody Street, Waltham, Massachusetts. Information pertaining to the quarantine, its enforcement, and location of inspectors can be obtained from the Waltham office.

The regulated area is classified as the "generally infested area" and the "suppressive area." The latter includes the western part of the New England States, except northern Vermont and the southwestern part of Connecticut. It extends into part of eastern New York in a bulge fashion to a point approximately 40 miles northwest of Albany. The regulated area is divided into 20 districts, three of which are in New York State.

The Division of Gypsy and Brown-tail Moths Control cooperated in this work by furnishing information pertaining to infestation conditions, the location of shippers in the suppressive area, and by inspecting non-commercial, regulated articles in the Greenfield area.

This Division and the New York Conservation Department have full-time gypsy moth employees throughout the suppressive area, the latter organization working within the State only. For some time mutual consideration has been given to the practicability of using some of these employees to aid the Division of Japanese Beetle Control by making inspections and issuing certificates for non-commercial shipments, when requested by shippers in their localities. Consideration has also been given to making more frequent contacts with field employees of these three units to arrange work programs within the areas of mutual interest. The enforcing agency has recently been supplied with the names of eight Federal and six State employees who are qualified for such cooperative work.

II. Pennsylvania State Gypsy Moth Quarantine

The State gypsy moth quarantine and its regulations are enforced by the Bureau of Plant Industry of the Pennsylvania Department of Agriculture in cooperation with the Federal Gypsy and Brown-tail Moths Control Division with headquarters at 354 North River Street, Wilkes-Barre, Pennsylvania. The

isolated area under regulation contains approximately 352 thousand acres in the Wilkes-Barre--Scranton section of northeastern Pennsylvania. Mr. C. F. Campbell of the Pennsylvania Bureau of Plant Industry is in charge of enforcing the quarantine and is assisted by Mr. C. J. Kilgallen of this Division and six State inspectors. The following statement is largely a condensation of Mr. Kilgallen's annual report of the quarantine inspection work for the fiscal year 1946:

The quarantine inspection work increased approximately 20 per cent over the previous year. The use of signed agreements, which enabled the employees to maintain an efficient service, was an outstanding feature. This use of permits and certificates proved very satisfactory and created a cooperative spirit with the carriers, operators, and dealers, a very high percentage of whom complied completely with the requirements. A total of 7,499 acres of timberland was examined previous to the issuance of agreements. This resulted in the discovery and destruction of 853 egg clusters, 108 larvae, and 16 pupae. In a few cases it was necessary to examine timber on skidways before loading.

Scrap iron, other metals, and old rubber were inspected at 42 concentration points, 14 of which were scrap yards where a total of 2,527 junked motors had to be inspected before movement. One new egg cluster was found on scrap iron in a yard in the city of Pittston.

A total of 1,429 outdoor advertising signboards were inspected at 830 points along highways within the regulated area. At 90 per cent of these locations tree growth was growing at distances from 5 to 100 feet from the signboards. There were 15 advertising companies operating in the area who moved signboards or parts of them within or beyond the area. Seven of these companies operate from locations beyond the regulated area with storage plants in Stroudsburg and Shenandoah, Pennsylvania; Westminster, Maryland; Cleveland, Ohio; Chicago, Illinois; and Milwaukee and Waukesha, Wisconsin.

There were 28 dealers in nursery stock operating during the year. All stock handled by these dealers originated outside of the regulated area at points in New York, New Jersey, Illinois, Iowa, and Pennsylvania.

Periodic checks were made at 42 freight and express stations. During the months of October, November, December, March, and April daily visits were made to freight and express stations

in Wilkes-Barre and Scranton, Pennsylvania. A total of 2,773 visits were made and 39,694 cars of freight and express checked. This resulted in finding 12 violations of the Pennsylvania State Quarantine. Excellent cooperation was received by freight and express agents.

There were 139 violations recorded during the year, most of which were committed by first offenders. All of these people were sent letters of explanation and many of them were interviewed. There were only 14 second offenders and even fewer who violated the quarantine for three or more times. These offenders were notified that further violations would result in prosecution. One prosecution and fine was imposed during the year.

DDT in oil solution was distributed for the first time with an axial-flow blower in connection with the quarantine work. Treatment was applied around colliery and scrap yards and railroad sidings. The objective of this work was to reduce or eliminate the risk of spread by carriers of restricted materials. Approximately 2,896 acres and 91 miles of railroad sidings were treated, requiring 295 man-hours of work. The previous year 568 man-hours were needed to examine 1,868 acres and 80 miles of railroad sidings.

A detailed record of the materials shipped under the Pennsylvania State Gypsy Moth Quarantine during the fiscal year 1946 appears in the Appendix.

* * *

FOREST SITE CONDITIONS AND THE GYPSY MOTH

Mention was made in the last annual report that as a result of ecological studies of forest sites and their relation to gypsy moth abundance Messrs. S. H. Spurr, Assistant Professor of Forestry at Harvard University; E. W. Littlefield, Superintendent of Forest Investigations, Division of Lands and Forest, New York Conservation Department; and H. A. Bess, Division of Forest Insect Investigations of this Bureau, in cooperation with other members of that Division had prepared an article for early publication on the subjects "Relation of Forest Site Conditions to Gypsy Moth Abundance" and "Forest Practices which Develop Resistance to Gypsy Moth."

The paper has been approved for publication as a Harvard Forest bulletin and will soon be available for distribution.

* * *

RECENT CHANGES IN PERSONNEL ASSIGNMENTS

I. Emory Dwight Burgess

Emory Dwight Burgess was transferred to this project on August 11, 1946, from the Japanese Beetle Laboratory of the Division of Fruit Insect Investigations at Moorestown, New Jersey. He was with that unit from 1937 on, doing research work with beetle attractants and insecticides, including sprays, dusts, and fumigants, except for nearly 5 years spent in the United States Army, during which time Mr. Burgess was associated with sanitation, mosquito control, public health, and other military activities in this country and in Europe. His previous experience includes work with the Gypsy Moth, European Corn Borer, and Dutch Elm Disease projects. He graduated from Massachusetts State College at Amherst in 1929 and received an M. S. from Ohio State University in 1931.

His assignment in this Division will involve close working relationship with research agencies of the Bureau such as the Divisions of Forest Insect Investigations, Insecticide Investigations, and Control Investigations. He will also be responsible for checking the results of surveys and control operations and applying the results of research to the field programs of this Division.

II. William Vern O'Dell

William Vern O'Dell was employed by this Division on August 16, 1946, to act as full-time assistant to the entomologist in charge in planning, directing, and coordinating the cooperative gypsy moth survey and control programs conducted in the State of New York. He comes to the Division well qualified by experience to efficiently perform the duties of this very important assignment. Mr. O'Dell graduated from the Hoosick Falls, New York, high school in the spring of 1923 and in October of that year accepted employment in gypsy moth work with the Bureau of Forest Pest Control of the New York Conservation Department. Except for the first 3 months of service, when Mr. O'Dell was detailed to work in a crew, he has always been employed in a supervisory capacity, assuming increasingly greater responsibilities as he acquired more experience. In August 1935, the United States Forest Service, under a cooperative arrangement worked out with the New York State Conservation Department, appointed Mr. O'Dell to the position of Principal Foreman and placed him in direct charge of a C. C. C. camp in eastern New York organized primarily for gypsy moth

control, but at which other important programs, including blister rust control, stream development, truck trail construction, and forest stand improvement, were conducted. In November 1941, this C. C. C. camp was abandoned and Mr. O'Dell resumed work with the Bureau of Forest Pest Control where he continued employment until he took up work with this Division.

Because of his wide knowledge of the problems involved and the Federal and State personnel engaged in this cooperative undertaking, together with his demonstrated ability to organize, direct, and coordinate survey and control programs, Mr. O'Dell's appointment to his present position should prove equally beneficial to the New York State Conservation Department and this Division. He is stationed in Albany, New York, and works in close cooperation with and under the general direction of Mr. W. M. Foss, Superintendent of the Bureau of Forest Pest Control and collaborator of the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture, and Mr. J. M. Corliss of this Division.

* * *

BUSINESS ADMINISTRATION UNIT

We regret to report that Harry B. Dalton, In Charge of the Business Administration Unit until his retirement on account of disability June 30, 1944, passed away at his home in Greenfield, Massachusetts, on Easter Sunday, April 21, 1946. Mr. Dalton was the third man employed on the gypsy moth project, having been appointed July 30, 1906. At the time of his retirement, he had performed more years of service on this project (38 years) than any other employee.

Office budget for the fiscal year 1946 was submitted to the Bureau on May 26, 1945. It covered a total appropriation allotment of $276,100. This amount represented an increase in appropriation of $35,000 for gypsy moth work, but did not include funds to cover the cost of the Federal Employees' Pay Act of 1945 effective July 1, 1945. Inasmuch as the $35,000 increase was appropriated for control and inspection and certification, $17,500 was later transferred to the Division of Japanese Beetle Control and the budget was accordingly reduced to $258,600. In April, $38,700 additional was made available; $32,700 to cover the cost of the Federal Employees' Pay Act and $6,000 to cover overtime costs due to the 44-hour workweek during the period July 1 to September 8, 1945. Deficiency funds totaling $61,000 were made available during the latter part of May 1946, so that a total allotment of $358,300 was available to the Division during the year. The receipt of this deficiency appropriation so late in the fiscal year created an unusual rush of business, which required additional purchases of supplies and materials resulting in additional vouchers which had to be processed and an increase in accounting records.

Lease with Carlton P. Davenport of Shelburne Falls, Massachusetts, covering buildings used by this Division for office, storage, and repair shop at Greenfield, Massachusetts, was renewed for the fiscal year 1947. Since renewal, however, one of the buildings has been released to Mr. Davenport with corresponding reduction in rental effective August 16, 1946. The building with accompanying land has now been sold to private interests. Lease with E. W. Thompson for land at Moosic, Pennsylvania, was renewed for the fiscal year 1947. The land was sold to Gomer W. Morgan of Scranton, Pennsylvania, by deed dated July 8, 1946, with rental to be paid to Mr. Morgan beginning August 1, 1946. Lease with Greenfield Storage Co., Inc. for cold storage space at Greenfield, Massachusetts, was extended by mutual agreement for the fiscal year 1947.

Reports were received from States cooperating with this Division in the control of the gypsy and brown-tail moths covering expenditures during the calendar year 1945 as follows:

State	Amount
Maine	$ 18,500.00
New Hampshire	37,081.55
Vermont	1,684.33
Massachusetts	871,056.86
Rhode Island	11,288.71
Connecticut	23,781.40
New York	90,913.56
New Jersey	12,238.02
Pennsylvania	79,900.00
Total	$1,146,444.43

The figures for Maine, New Hampshire, Vermont, and Massachusetts include expenditures by other State departments, cities, towns, counties, or other State political divisions. In New Hampshire and Massachusetts, the amount for these States include expenditures by private individuals, corporations, or other organizations insofar as available.

Instructions and information were issued to Division personnel relative to their pay status due to the Federal Employees' Pay Act of 1945, filling station contracts, penalty mail reports, revised travel vouchers, retirement, and other personnel data.

Further reports of work conducted in the Business Administration Unit have been summarized under appropriate subheadings.

I. Accounting and Payroll Section

A. Appropriation records

The following table indicates the appropriation allotment available for the fiscal year 1946 and the status of obligations as of September 4, 1946:

Appropriation Allotment		$358,300.00
Obligations (Entered on books to 9-4-46)		
Salaries		
Base Salaries	$248,296.01	
Overtime Compensation	6,393.85	
Night Differential	423.84	
Holiday Pay	107.93	$255,221.63

Appropriation Allotment (carried forward)			$358,300.00
Obligations (Entered on books to 9-4-46)			
Salaries (carried forward)		$255,221.63	
Letter of Allotment (L. A. #11)			
Wages	$ 504.11		
Travel and Subsistence	12,101.01		
Long Distance Telephone, Telegraph & Cable	1,056.65		
Other Communication Costs ...	1,347.77		
Rents & Other Utility Serv. (other than formal leases) .	800.33		
Other Contractual Services	35,360.96		
Supplies and Materials	29,206.20		
Equipment	4,879.48	85,256.51	
Freight, Express, etc.		1,130.25	
Leases		9,689.40	
Washington Purchase Orders		1,402.31	
Central Stores Requisitons		168.09	352,868.19
Balance			$ 5,431.81

The amount for Other Contractual Services in the above table includes $30,348.50 for the employment of commercial aircraft concerns to spray areas in New York and Pennsylvania with DDT concentrate. This work was made possible by deficiency funds appropriated and made available during the last 2 months of the fiscal year.

Financial records have been maintained and statements prepared in accordance with the office budget for the year, as well as by work projects, States, and objects of expenditure. Beginning July 1, 1945, payrolls were prepared on a biweekly basis instead of semimonthly as heretofore.

B. Savings bonds

Allotments for the purchase of savings bonds were gradually reduced during the fiscal year from $927.52 for the period July 1-14, 1945, to $670.69 for the period June 16-29, 1946. This decrease was mainly due to the cancellation of payroll allotments at the end of the War by employees who required funds for other purposes.

Employees of this Division have purchased bonds under the payroll savings plan since its inception on July 16, 1942, in the following amounts:

Fiscal Year 1943	$17,512.50
Fiscal Year 1944	21,806.25
Fiscal Year 1945	20,850.00
Fiscal Year 1946	20,681.25
Total	$80,850.00

The small decrease in the value of bonds purchased in the fiscal year 1946 as compared with the amount purchased in the fiscal year 1945, while payroll deductions were undergoing a reduction of more than 25 per cent during the year, is explained by the addition of two payroll periods. Previous to 1946, deductions were made on a semimonthly basis (24 payrolls per year), whereas biweekly payrolls (26 per year) were inaugurated at the beginning of the fiscal year 1946.

C. Income taxes

The total amount of Federal taxes withheld from salaries of employees of this Division has increased each year since the beginning of the tax withholding plan on January 1, 1943. Incomplete figures for the calendar year 1946 indicate a reduction from the 1945 total, reflecting the lower tax rates which became effective on salaries paid on or after January 1, 1946. Total amounts withheld for taxes are shown below by calendar years:

Calendar Year 1943	$16,802.20	(includes Victory Tax)
Calendar Year 1944	23,767.80	
Calendar Year 1945	28,044.40	
Calendar Year 1946	11,589.95	(first 6 months only)

Reports on Treasury Form W-1 and Treasury checks for the amounts reported were forwarded each quarter to the Collector of Internal Revenue at Boston, Massachusetts, as well as an annual report for the calendar year 1945 on Treasury Form W-3. Withholding statements (Treasury Form W-2) were furnished to employees at the end of the calendar year, or at the completion of their service.

II. Auditing and Voucher Section

A. Auditing

Over 21 hundred vouchers were audited and processed for payment during the fiscal year, including payrolls, supply vouchers, travel accounts, and adjustment vouchers. This is an increase of

over 300 vouchers over the fiscal year 1945 and is principally due to deficiency funds made available the last 2 months of the year.

At the close of the year over 58 per cent of the employees of this Division were continuing to purchase United States savings bonds under the payroll allotment plan. Bond Issuance Schedules and Schedules of Transfers were audited and transmitted to the Regional Office following submission of biweekly payrolls. All bonds issued were received by the designated agent at the Greenfield office and delivered or forwarded to the employees concerned.

B. Contracts and leases

Contracts for storage of Government-owned motor vehicles and aircraft which were negotiated during the fiscal year are as follows:

Connecticut	5
Massachusetts	11
New York	7
Vermont	6
Pennsylvania	29
Total	58

The above total represents an increase of 31 contracts made over the fiscal year 1945 when contracts were kept to a minimum due to war conditions and mileage limitations.

Public utilities contracts in effect during the fiscal year 1946 were the same as for the fiscal year 1945 and included eleven for telephone service, three for electricity and power, two for water, and one for gas.

Property leased by the Division during the year was the same as for the previous fiscal year and included office, repair shop, and storage buildings at Greenfield, Massachusetts, headquarters; space for cold storage of sex attractant material at Greenfield, Massachusetts; and land in Pittston Township, Pennsylvania, for USDA-owned temporary storage buildings used for the storage and repair of Government equipment in the Pennsylvania area.

C. Motor vehicle records

On July 1, 1945, there was a total of 168 motor vehicles on hand. During the fiscal year 1946, six ½-ton pickup trucks were dismantled, leaving a balance of 162 on hand as of July 1, 1946. A break-down of the types of motor vehicles on hand is shown in the report under the Purchasing, Inventory and Property Section.

There is furnished below a table showing operating costs, mileage and cost per mile for the various types of motor vehicles owned by this Division during the fiscal year. Operating costs for 16,670 miles on vehicles loaned to other Government agencies are partially estimated:

Vehicle	Operating Costs	Total Mileage	Total Cost Per Mile
Passenger-carrying cars	$3,621.29	161,934	$.02236
Pickup trucks, ½-ton	11,283.76	746,173	.01512
Stake-body trucks, 1½-ton	2,544.42	46,027	.05528
Stake-body trucks, 3½-ton	1,221.75	4,681	.26
Stake-body trucks, 1-ton	49.19	2,984	.01648

The high cost per mile of operation on 1½-ton trucks is due to the development of heating units in spray tanks mounted on several of these trucks. The motors of these trucks were operated for a considerable period of time in a stationary position in order to heat the DDT mixture to the proper temperature for use in aircraft spraying. The high cost per mile of operation on 3½-ton trucks was due to a heavy overhaul job on one of the three trucks under this classification.

There were 780 thousand miles allotted to this Division for the operation of Government motor vehicles during the fiscal year. Due to the end of the War, the mileage conservation program was discontinued in September 1945. Mileage records, however, were maintained throughout the fiscal year and are summarized below:

Total mileage of vehicles owned by this Division ...	961,799
Total mileage of vehicles loaned to other agencies .	16,670
Total actual mileage chargeable to this Division ...	945,129

Much of this increase over the mileage originally allotted was due to additional travel incurred in connection with the supplemental allotment of $61,000 made available in May 1946.

The annual reports for the fiscal year 1946 covering all motor vehicles owned by this Division were transmitted (in duplicate) to the Bureau on August 2, 1946, on Forms A-30 provided for this purpose.

D. Penalty mail

The required reports of material bearing the penalty indicia covering mail used by this Division were forwarded to the Bureau during the fiscal year as follows:

Quarter ending September 30, 1945	4,241	pieces
Quarter ending December 31, 1945	3,824	"
Quarter ending March 31, 1946	3,696	"
Quarter ending June 30, 1946	4,358	"
Total	16,119	"

The annual inventory report for this Division on material bearing the penalty indicia was submitted to the Bureau on August 7, 1946, indicating a total of 263,023 pieces on hand as of June 30, 1946, including envelopes, cards, tags, and other articles.

E. Telephone tolls and telegrams

The operating budget for the fiscal year included $1,000 for telephone tolls and telegrams. The actual obligation for these items was $1,056.65, the excess of $56.65 being due to the increased volume of long distance telephone calls and telegraph service in connection with the expenditure of the deficiency appropriation received in May 1946.

F. Credentials

Records of the issuance and return of all credentials were maintained throughout the year, including Department drivers' licenses, Federal and State credentials, tax exemption certificates, gasoline credit cards, Government transportation identification cards, metal badges, etc. In cases of separation from the service during the fiscal year, all credentials and other property were accounted for before release of final pay check.

III. Personnel, Claims, and Leave Section

Appointments in effect (regular employees) fiscal year 1946, including reallocations and promotions effective during the year, are as follows:

List of Appointed Personnel

Name	Grade	Title	Remarks
Sheals, Ralph A.	P-6	Entomologist	
Crossman, Samuel S.	P-5	"	
Blaisdell, Harry L.	P-5	"	
Corliss, John M.	P-5	"	From P-4 - 1-9-46
Whittam, Donald	P-4	Aircraft Pilot	
Hood, Clifford E.	P-3	Entomologist	
Hanley, William H.	P-3	"	
Bancroft, Frank N.	P-3	"	
Bancroft, Winthrop W.	P-3	"	
Bean, Henry N.	P-3	"	
Pruett, Arthur J.	P-3	Agent (Ent.)	
Stark, Lucius R.	P-3	" "	
Campbell, William H.	P-3	Equip. Eng.	
Dion, Raymond J.	P-3	Aircraft Pilot	
Mackiewicz, Valerian W.	P-3	" "	Temp.Appt.Pend.Cert.3-1-46
Leutholt, Clifford J.	P-3	" "	Resigned C.O.B. 8-8-45
Graham, Frank W.	P-2	Entomologist	
Otis, Orren C.	P-2	"	
Regan, John W.	P-2	"	
Rich, Fenner C.	P-2	"	
George, Mike	P-2	Agent (Ent.)	
Kilgallen, Clarence J.	P-2	" "	
Harding, Warren G.	P-2	" (Dist.Sup.)	
May, Edward C.	P-2	" " "	
Kurtz, Willis C.	P-2	Topo. Eng.	
Phillips, Saul	P-2	Agent (Cont.Sup.)	Reallocated 7-1-45
Bosworth, Hartley L.	CAF-12	Admin. Officer	
Munzing, Frank	CAF-9	Admin. Asst.	
Walsh, William T.	CAF-9	" "	
Wooldridge, Reginald	CAF-7	" "	
Parker, Abraham J.	CAF-7	" "	
Clement, Clarence	CAF-7	" "	From CAF-5 - 2-7-46
Ellis, Ralph C.	CAF-5	Clerk	
Skinner, Melvin F.	CAF-5	Clerk Steno.	
Mitchell, David W.	CAF-5	" "	Ret.from Mil.Fur. 11-19-45
Warner, Rita G.	CAF-5	" "	
Hadley, Ethel P.	CAF-4	" "	
Sicard, Harriet P.	CAF-4	" "	
Cyr, Ethel M.	CAF-4	" "	From CAF-3 - 1-15-46
Merritt, Lance R.	CAF-4	Storekeeper	
Glass, Byron L.	CAF-4	"	
Stone, Viola M.	CAF-3	Clerk-Steno.	
Estabrook, Harland B.	CAF-3	" "	Trans.to Vet.Adm.C.O.B. 3-31-46
Smith, Margaret A.	CAF-2	" "	
Anderson, Frank	SP-7	Agent	
Andrews, John (Jr.)	SP-7	"	

List of Appointed Personnel (continued)

Name	Grade	Title	Remarks
Beaulieu, Joseph A.	SP-7	Agent	
Braun, Carl F.	SP-7	"	
Butler, Lloyd E.	SP-7	"	
Cyr, Dennis J.	SP-7	"	Ret.from Mil.Fur. 7-16-45
Dickey, Stanley B.	SP-7	"	Ret.from Mil.Fur. 7-16-45
Hardy, Richard L.	SP-7	"	
Holbrook, Ralph F.	SP-7	"	
LaPointe, Frank J.	SP-7	"	
LaRoche, Frank X.	SP-7	"	
Magnani, Ettore	SP-7	"	
Maker, Bernard F.	SP-7	"	
Marley, Owen J.	SP-7	"	Disability Ret.C.O.B.10-31-45
May, Walter R.	SP-7	"	
McFall, Norman S.	SP-7	"	
Mitchell, Buell B.	SP-7	"	
Moulton, Alfred R.	SP-7	"	Ret.from Mil.Fur. 12-3-45
Nelson, Ivory A.	SP-7	"	Ret.from Mil.Fur. 1-7-46
Mohr, Michael	SP-7	"	
Mullen, Stephen F.	SP-7	"	
Peirce, Laurence L.	SP-7	"	
Smith, Andrew O.	SP-7	"	
Sullivan, Edmund H.	SP-7	"	
Tierney, George C.	SP-7	"	
Tobin, Henry H.	SP-7	"	
Treadwell, Charles A.	SP-7	"	
White, Herbert W.	SP-7	"	
Wood, James	SP-7	"	
Snelling, Samuel W.	CPC-10	Mech. Supt.	
Rhoades, Francis A.	CPC-10	Air. Mech.	From CPC-7 - 12-16-45
Clough, Oren C.	CPC-9	Mech. Supt.	
Millette, Alfred A.	CPC-8	" "	
Haley, Cornelius W.	CPC-7	Mechanic	
Miller, David J.	CPC-7	"	
Pauling, William J.	CPC-7	"	
Laliberte, Euclide P.	CPC-6	"	From War Service to Reinstatement
Reed, Charles C.	CPC-4	Laborer-Watchman	
Wrenn, William J.	CPC-4	"	
Ingraham, Allen H.	CPC-4	"	
Pranker, Edward	CPC-4	"	
White, Peter S.	CPC-4	"	
Thurlow, Daniel D.	CPC-3	Janitor	Reallocated 9-23-45
Ames, Harold A.	Unall.	Agent (St.-Supv.)"CC"	
Osgood, Wilfred A.	Unall.	Collab."CC"	

A. Personnel ceilings

This Division was allotted a personnel ceiling of 83 employees for the first quarter of the fiscal year and 87 for the remainder of the year. The ceiling for the first quarter did not include two cooperative (unallocated) positions. These positions were brought under the ceiling in the second quarter.

B. Temporary assignments to other divisions

An aircraft pilot was temporarily transferred to the White-Fringed Beetle Project in the Southern States during the period July 1 to August 18, 1945. One pilot was assigned to the Division of Fruit Insect Investigations for 3 days in September 1945. One pilot was temporarily assigned to the Division of Forest Insect Investigations at Beltsville, Maryland, from September 17 to October 10, 1945 and another from October 14 to 27, 1945. Two pilots were also assigned to the same Division from November 15 to 21, 1945.

C. Temporary assignments from other divisions

One aircraft pilot was loaned to this Division by the White-Fringed Beetle Project during the latter part of January 1946 for an indefinite period. This pilot (Robert E. Frownfelter) was permanently transferred to this Division effective July 1, 1946.

D. Appointments

Valerian W. Mackiewicz was temporarily appointed, pending certification, as an Aircraft Pilot (P-3) effective March 1, 1946.

E. Collaborator appointments

The number of State employees appointed as collaborators (without compensation) in this Division ranged from 87 on July 1, 1945, to 118 on June 30, 1946. This increase was due to additional funds made available by the States of New York and Pennsylvania for gypsy moth control in those States.

F. Retirements

Owen J. Marley (Agent SP-7) retired on account of physical disability effective at close of business October 31, 1945. Mr. Marley was first employed under Letter of Authorization in the Bureau on October 15, 1915, and was appointed Agent February 2, 1931, serving in that capacity until his retirement.

G. Military service

The following five employees of this Division returned from military service during the fiscal year:

Name	Grade	Title	Date Restored to Duty
Dennis J. Cyr	SP-7	Agent	July 16, 1945
Stanley B. Dickey	SP-7	Agent	July 16, 1945
David W. Mitchell	CAF-5	Clerk-Steno.	Nov. 19, 1945
Alfred R. Moulton	SP-7	Agent	Dec. 3, 1945
Ivory A. Nelson	SP-7	Agent	Jan. 7, 1946

All but one of the employees who were in the armed services have now returned to duty.

H. Efficiency ratings

A summary of efficiency ratings for employees of this Division covering the year ending March 31, 1946, is indicated below:

Classification	Rating			
	Excellent	Very Good	Good	Total
Professional	7	16	0	23
Sub-Professional	0	20	8	28
Clerical, Administrative, Fiscal	2	16	0	18
Crafts, Protective, Custodial	1	13	0	14
Totals	10	65	8	83

I. Organizational charts and allocation of positions

A revised organizational chart was approved by the Department in October 1945. This chart included six additional positions for which forms covering allocation were forwarded to the Bureau. The other changes in the chart involved areas and supervision, so that it was necessary in a few instances to rewrite job descriptions.

J. Promotions, reallocations, etc.

During the year the status of seven employees of this Division were changed as follows:

Number of Employees	From		To	
	Title	Grade	Title	Grade
1	Entomologist	P-4	Entomologist	P-5
1	Agent	Unallocated	Agent (Cont. Supv.)	P-2
1	Clerk-Steno.	CAF-5	Admin. Asst.	CAF-7
1	Clerk-Steno.	CAF-3	Clerk-Stenographer	CAF-4
1	Mechanic	CPC-7	Aircraft Mechanic	CPC-10
1	Mechanic (WS)	CPC-6	Mech. (Permanent)	CPC-6
1	Unsk. Laborer	Unallocated	Janitor	CPC-3

In addition to the foregoing, 70 employees of this Division received periodic within-grade promotions during the year. The increase over the previous year was due to provisions of the Federal Employees' Pay Act of 1945, effective July 1, 1945, whereby periodic promotions were granted every 12 and 18 months instead of every 18 and 30 months.

K. Transfers

Harland B. Estabrook (Clerk-Stenographer - CAF-3) was separated by transfer to the Veterans Administration in Boston, Massachusetts, at close of business March 31, 1946.

L. Changes in headquarters

Three changes in headquarters were made during the year as indicated below:

Employee	From	To
Andrew O. Smith	Hamlin, Pa.	Wilkes-Barre, Pa.
Frank Anderson	Scranton, Pa.	Lake Ariel, Pa.
Clarence Clement	Greenfield, Mass.	Wilkes-Barre, Pa.

The moving of employees' household goods at Government expense was not involved for any of these changes.

M. Letter of Authorization employment

In July 1945, twelve men were employed under Letter of Authorization. Seven of these men were stationed on Cape Cod, Massachusetts, during the pupal collection work and five in Pennsylvania on trapping work. In June 1946, one man was employed in Pennsylvania to assist in aerial spraying.

N. Accidents

Five personal injury cases were reported requiring medical treatment. One of these was caused by the explosion of a gasoline tank. The employee was hospitalized.

Eight motor transportation accidents were reported, one of which involved personal injury. In connection with these cases, action against three private owners is pending.

Instructions concerning personal injuries sustained while performing official duties, and instructions and information concerning motor transportation accidents involving Government-owned motor equipment were revised and copies furnished to all employees of the Division.

O. Civil Service

The Springfield, Massachusetts, branch office of the United States Civil Service Commission was closed during the year and all business was transferred to the First Civil Service Regional Office at Boston.

The United States Civil Service Commission was authorized by Executive Order No. 9512 to establish allocation standards covering all positions in the Federal Government. On February 8, 1946, we were advised by the Bureau that the Commission was conducting a survey to establish such standards for professional and sub-professional positions in the field of entomology. At the same time questionnaires were furnished to be completed by a representative number of such employees of this Division, a copy of which was to be sent to the First United States Civil Service Region at Boston. Representatives of the Regional Classification Division of that office conferred with various employees who had completed the questionnaires both at this office and in the field. Appreciation was expressed by the Regional Civil Service Director for the cooperation shown by the various employees of this Division who were interviewed.

P. The usual inquiries relative to employment and past service were answered and the various reports required by the Washington office were submitted when due.

IV. Purchasing, Inventory, and Property Section

A. Purchase orders

The following data is submitted in connection with purchases made during the fiscal year 1946:

Number of purchase orders issued at Greenfield, Mass.	1,106
Number of purchase orders issued at Wilkes-Barre, Pa.	483
Number of requisitions prepared on which Bureau in Washington issued purchase orders	13
Number of orders placed with Central Supply Section, Washington, D. C.	34
Formal bid invitations prepared for services, supplies, and materials (coal, motors, hangar space, etc.)	8
Total	1,644

This is an increase of approximately 250 orders over the fiscal year 1945, which is due to deficiency funds made available during the latter part of the year.

B. Property report

A report of nonexpendable property for this Division for the calendar year 1945 was submitted to the Bureau on February 21, 1946. Actual physical inventory was started on December 11, 1945.

C. Disposal of junk and other unserviceable materials

One sale was held at Greenfield, Massachusetts, in November 1945 for the sale of junk metal, scrap rubber, and storage batteries. One sale was held at Wilkes-Barre, Pennsylvania, in January 1946 for the disposal of junk iron and steel, unserviceable storage batteries, tires, inner tubes, and waste paper. One lot of 3,755 pounds of waste paper was disposed of at Greenfield, Massachusetts, in February 1946 under a local Post Office contract.

D. Sale of surplus property

One sale consisting of several lots of surplus chairs, old desks, metal file boxes, trays, and a mimeograph was held in Greenfield, Massachusetts during April 1946 under authority of the Chairman, Area I, Agriculture Equipment Committee.

E. Transfers of property to other agencies

QUANTITY	ITEM	TRANSFERRED TO
1 2 1	auto jack used truck wheels, 5.25 used canopy top for pickup truck	White Pine Blister Rust Control Cambridge, Massachusetts
115 lbs.	Santomerse D Powder	Div. of Domestic Plant Quarantines Gulfport, Mississippi
4	visible index book units (G-W)	U.S.D.A. Branch Library Philadelphia, Pennsylvania
1	12-inch typewriter	Soil Conservation Service Newark, Delaware
1	12-inch typewriter	Div. of Domestic Plant Quarantines Hicksville, L. I., New York
1	12-inch typewriter	Div. of Control Investigations El Paso, Texas
1	metal transfer box	Soil Conservation Service Newport, Rhode Island
1	auto jack	White-Fringed Beetle Control Gulfport, Mississippi

F. Transfers of property from other agencies

QUANTITY	ITEM	TRANSFERRED FROM
1 1 1	GMC 4-ton commercial truck tractor (closed cab) trailer, spray, with 800-gal. tank & spray pump & engine cabin autogiro	Div. of Japanese Beetle Control East Orange, New Jersey
285 gal.	alcohol for use as antifreeze	Treasury Department Internal Revenue Service New York, New York

G. Loans of property to other agencies

QUANTITY	ITEM	LOANED TO
3	Pickup trucks in December 1945	Post Office Northampton, Massachusetts
1 1	Pickup truck in December 1945 1½-ton pickup truck " "	Post Office Greenfield, Massachusetts
1	1½-ton truck and spray unit in March 1946	D. E. Parker Div. of Forest Insect Invs. Columbus, Ohio
1	1½-ton truck in April 1946	R. B. Friend, State Entomologist State of Connecticut (for cooperative work with Div. of Forest Insect Invs., New Haven, Conn.)

H. Loans of property from other agencies

QUANTITY	ITEM	LOANED FROM
150	50-gallon drums in November 1945	Army Air Base Tobyhanna, Pennsylvania

I. Motor vehicles

Make	Year	On Hand 7-1-45	Dismantled	Rec'd.	On Hand 7-1-46	
					Pa.	N.E.-N.Y.
Passenger Carrying						
Buick Sedan	1940	1	0	0	0	1
Chevrolet Sedan	1938	1	0	0	1	0
" "	1940	2	0	0	1	1
" "	1941	1	0	0	0	1
Ford Sedan	1936	2	0	0	0	2
" "	1937	1	0	0	0	1
Plymouth Sedan	1941	3	0	0	1	2
Ford Station Wagon	1940	1	0	0	0	1
Chevrolet Carryall	1936	2	0	0	2	0
" "	1939	2	0	0	2	0
Totals		16	0	0	7	9
Trucks, ½-ton Pickup						
Dodge (canopy top)	1935	6	0	0	0	6
Ford " "	1936	70	5	0	34	31
Plymouth " "	1939	20	1	0	9	10
Totals		96	6	0	43	47
Truck, 1-ton Stake Body						
Chevrolet	1941	1	0	0	1	0
Totals		1	0	0	1	0
Trucks, 1½-ton Stake Body						
Chevrolet	1940	1	0	0	1	0
Dodge	1938	1	0	0	1	0
Diamond T	1937	6	0	0	6	0
Ford	1936	44	0	0	25	19
Totals		52	0	0	33	19
Trucks, 3½-ton Stake Body						
International	1936	3	0	0	2	1
Totals		3	0	0	2	1
Grand Total		168	6	0	86	76

J. Spraying equipment

Spray Units*	Year	On Hand 7-1-45	Rec'd.	On Hand 7-1-46		Totals
				Penna.	Mass.	
Bean high-pressure	1936	10	0	4	6	10
" " "	1937	10	0	10	0	10
" low pressure	CCC	2	0	0	2	2
Conversion units "A" series	1937	10	0	8	2	10
Conversion units "B" series	1938	10	0	0	10	10
Buffalo Turbine Blower Dusters	1946	0	4	1	3	4
Totals		42	4	23	23	46

*These are self-contained units, operating under their own power.

Portable Water Pumpers	Model	Year	On Hand 7-1-46		Totals
			Penna.	Mass.	
Fitzhenry-Guptill	---	1927	0	3	3
Pacific	N	1933	3	2	5
Evinrude	DDV	1927	1	1	2
Totals			4	6	10

K. Tractors

Kind	Model	Year	On Hand 7-1-45	Trans-ferred	Rec'd.	On Hand 7-1-46	
						Pa.	N.E.-N.Y.
Caterpillar	22	1936	1	0	0	0	1
GMC 4 ton	--	1937	0	0	1	1	0
Totals			1	0	1	1	1

L. Trailers

Kind	On Hand 7-1-45	Trans-ferred	Rec'd.	On Hand 7-1-46	
				Pa.	N.E.-N.Y.
Frehauf	1	0	0	1	0
Shop built for GM tractor	1	0	0	1	0
Buffalo	0	0	1	0	1
Totals	2	0	1	2	1

M. Sawdust mills

Kind	Model	On Hand 7-1-45	Trans-ferred	Rec'd.	On Hand 7-1-46	
					Pa.	N.E.-N.Y.
Fitchburg	80	1	0	0	0	1
"	187	1	0	0	0	1
Totals		2	0	0	0	2

APPENDIX

Appendix

GYPSY MOTH SEX ATTRACTANT SURVEY
(Three Seasons' Summary)

1944

State	No. of Townships	Town Acreages	Miles of Road	Number Traps Put Out	Number Traps Catching	Number Males Caught
Massachusetts	2	27,082	82	150	108	1,730
Connecticut	13	249,833	1,430	795	21	60
New York	131	3,708,142	10,777	7,843	179	541
Pennsylvania	108	1,562,702	4,743	6,782	304	678
New Jersey	27	146,897	197	700	1	1
Grand Totals	281	5,694,656	17,229	16,270	613	3,010

1945

Massachusetts	2	27,082	82	150	115	1,578
Connecticut	12	189,324	865	607	71	171
New York	109	2,802,988	8,504	6,573	322	644
Pennsylvania	106	1,929,550	5,422	6,941	73	195
New Jersey	39	98,709	131	511	0	0
Grand Totals	268	5,047,653	15,004	14,782	581	2,588

1946

Massachusetts	2	27,082	82	150	121	2,246
Connecticut	19	99,352	626	493	11	52
New York	91	3,468,930	8,318	4,543	17	59
Pennsylvania	101	2,140,100	6,125	5,555	39	95
New Jersey	39	449,100	500	1,003	0	0
Grand Totals	252	6,184,614	15,651	11,744	188	2,452

Appendix

COLLECTIONS OF FEMALE GYPSY MOTH PUPAE SUMMERS OF 1943 TO 1946, INCLUSIVE

Year	No. of Pupae Collected	No. of Tips Obtained	No. Charges Prepared
1943	1,089,025	541,530	19,761
1944	855,025	310,980	10,366
1945	552,070	203,640	8,585
1946	1,321,450	282,153	12,807*

*Of this material, 3,706 charges were used on the trap survey this summer and 68 for special tests. Approximately 3,333 charges of 30-tip strength material will be used by the Division of Insecticide Investigations, leaving 125,543 tips, or 5,700 charges at the rate of 22 tips per charge, for next season's survey. These 5,700 charges will be supplemented with 3,850 salvaged charges.

* * *

MANUAL SURVEY

Summary of Scouting and Treatment Work
Fiscal Year 1946

State	Open Acres Scouted	Woodland Acres Scouted	No. of Infestations Discovered	New Egg Clusters Treated	New Egg Clusters Not Treated
Vermont	201,774	80,680	85	295	3,443
Massachusetts	5,728	1,523	182	1,317	5,245
Connecticut	13,114	10,294	103	350	4,422
New Jersey	0	2,676	0	0	0
New York	191,991	348,512	213	1,792	38,232
Pennsylvania	24,571	87,462	142	19,187	874,110
Grand Totals	437,178	531,147	725	22,941	925,452

Appendix

SUMMARY OF SPRAYING WORK
FISCAL YEAR 1946

State	No. of Infestations Sprayed	Acres Sprayed				Pounds DDT Used
		Aircraft	Blower	Knapsack	Ground	
Vermont	73	0	106	58	0	233
Massachusetts	102	0	721	21	0	783
Connecticut	104	300	1,397	118	0	1,136
New York	184	22,413	138	2,116	0	17,243
Pennsylvania	276	39,488	13,692	1,038	22	35,334
*Grand Totals	739	62,201	16,054	3,351	22	54,729

*A grand total of 739 infestations covering 81,628 acres, were sprayed with 54,729 pounds of DDT.

530 pounds of DDT were used in spraying eight experimental plots in the Wendell State Forest, Wendell, Massachusetts, and two experimental plots in Warwick, Massachusetts, by the use of aircraft during the latter part of March and the first half of April, and in conducting demonstrations in the States of Maine, New Hampshire, and Massachusetts later in the year using aircraft at four locations and a blower at eight locations in effectively dispensing DDT. The ten experimental plots involved areas totaling 210 acres; 320 acres were sprayed in conducting demonstrations. It is estimated that 5 thousand persons witnessed the demonstration of these types of insecticide dispensing apparatus. They were greatly impressed with the effectiveness of application and the economy of operation of such equipment.

Appendix

COSTS

Cost of Obtaining Sex Attractant Material - 1946

	Federal	States	Totals
Salaries	$ 8,103.34	$3,980.05	$12,083.39
Subsistence	4,461.60	1,056.00	5,517.60
	$12,564.94	$5,036.05	$17,600.99
Supplies and Rental	526.48	17.67	544.15
Totals	$13,091.42	$5,053.72	$18,145.14

Total number of tips obtained	282,153*
Cost per tip - 1946	.064
Cost per charge - current material (15 tips)	.96
Cost per charge - treated material (22 tips)	1.40
Average previous 4-year cost per tip	.028

*Includes 100,000 tips for research studies.

Cost of Trapping Survey in Pennsylvania - 1946

The following cost figures are typical for similar work in other areas:

	Federal	States	Totals
Salaries	$5,383.75	$9,083.08	$14,466.83
Subsistence	435.70	96.70	532.40
Motor Vehicles	2,869.42	47.88	2,917.30
Supplies	398.49	297.00	695.49
Totals	$9,087.36	$9,524.66	$18,612.02
Trap material			
1612 - Current	$1,537.52		
1709 - Treated	1,726.09**		
2234 - Salvaged	----		
5555 traps	$3,263.61		3,263.61
Total cost			$21,875.63

Acreage surveyed	2,140,100
Average cost per trap for survey work	$3.94
Cost per acre	.01

**Based on average cost per trap ($1.01) charged with tips obtained the previous season at average cost of .046 per tip

Appendix

Cost of Manual Surveys

The Pennsylvania records for the fiscal year 1946 indicate that manual surveys at sites of trap catches cost $0.248 per acre; examinations at sites of areas treated experimentally, $0.639 per acre; 100-foot strip scouting, $0.065 per acre; and tree-by-tree examinations in the residential areas, $.223 per acre. The average cost for all types of manual surveys in that State was $0.181 per acre. These are typical of manual survey costs in other areas.

Cost of Spraying

Accurate records of spraying costs were kept in Pennsylvania for the season of 1946 showing results as follows:

Type of Equipment Used	Cost Per Acre	Acres Treated
Aircraft	$1.45	39,488
*Blowers	----	13,692
Knapsacks	7.24	1,038
Ground Machines	7.89	22

*The blowers were used primarily in areas where the main objective was to eliminate the hazard of spread. Therefore, treatment was not as intensive as would have been necessary to insure eradication of the pest in such locations. As the intensity of application was varied considerably (depending on the controlling factors present in the hundreds of individual areas sprayed with this type of apparatus) average per acre costs are considered of little value and, therefore, have not been included in the cost figures indicated above.

The cost figures, especially those recorded for spraying with aircraft, should not be used as a basis for computing costs for similar work by commercial concerns because they do not include insurance coverage for the personnel engaged in the work; purchase, maintenance, and insurance coverage costs of the equipment used; advertising and sales service charges; follow-up work; a fair margin of profit; and other items of like nature which must be taken into account by such concerns and in the aggregate involve considerable additional expenditure.

Appendix

DEFOLIATION CAUSED BY THE GYPSY MOTH
Calendar Years 1924 to 1946

1924 -	825 Acres	1935 -	540,769 Acres
1925 -	48,560 "	1936 -	428,622 "
1926 -	80,822 "	1937 -	608,760 "
1927 -	140,420 "	1938 -	313,954 "
1928 -	262,514 "	1939 -	492,640 "
1929 -	551,133 "	1940 -	485,636 "
1930 -	288,226 "	1941 -	468,021 "
1931 -	204,721 "	1942 -	44,577 "
1932 -	286,395 "	1943 -	34,845 "
1933 -	397,730 "	1944 -	250,149 "
1934 -	492,361 "	1945 -	821,487 "
		1946 -	622,919 "

* * *

SUMMARY OF GYPSY MOTH DEFOLIATION

State	Calendar Year	Degree of Defoliation				Total
		25%	50%	75%	100%	
		(acres)	(acres)	(acres)	(acres)	(acres)
Maine	1945	120,683	63,477	24,738	1,983	210,881
	1946	120,442	63,215	18,925	1,231	203,813
New Hampshire	1945	7,529	31,110	14,881	4,997	58,517
	1946	28,627	59,154	58,190	37,972	183,943
Vermont	1945	67,500	26,425	25	0	93,950
	1946	13,100	2,800	0	0	15,900
Massachusetts	1945	102,695	104,350	92,474	157,313	456,832
	1946	46,924	52,320	65,312	52,576	217,132
Rhode Island	1945	280	200	350	450	1,280
	1946	1,610	35	0	0	1,645
Connecticut	1945	5	4	2	5	16
	1946	103	57	155	171	486
Pennsylvania	1945	2	8	1	0	11
	1946	0	0	0	0	0
Totals	1945	298,694	225,574	132,471	164,748	821,487
	1946	210,806	177,581	142,582	91,950	622,919

Appendix

*RECORD OF MATERIALS SHIPPED UNDER
PENNSYLVANIA STATE QUARANTINE #24
ON ACCOUNT OF THE GYPSY MOTH
FISCAL YEAR 1946

Type	Volume	
	By Certificate	By Permit
Mine timbers (props, laggings, ties)	20,013 tons	17,353 tons
Nursery stock	50,344 pieces	8 pieces
Evergreen stock (Xmas trees, rhododendrons, Kalmias)	5,078 "	38 "
Evergreen boughs	98,580 pounds	1,200 pounds
Firewood	696 cords	3,429 cords
Saw logs	30,529 pieces	26,342 pieces
Lumber (salvaged and rough-edged)	1,909,506 board ft.	298,990 board ft.
Deciduous boughs	39,440 pounds	461,750 pounds
Surface stone	2,475 tons	824 tons
Scrap iron and metal	59,318 "	1,322 "
Scrap rubber	1,766 "	37 "
Building stone	56 "	11 "
Construction equipment	734 "	0 "
Cable reels	1,535	1
Steel drums	1,312	0
Monuments	19	0
Tool box	1	0
Mine motor	1	0
Dining car	1	0
Snow fence	500 feet	0
Trailers	4	0

*10,599 certificates and 7,871 permits were issued. 431 agreements were also arranged under the provisions of this quarantine. 854 egg clusters, 108 larvae, and 16 pupae of the gypsy moth were found and destroyed by the personnel engaged in enforcement of the quarantine.

Appendix

LARGE ITEMS OF SUPPLY

The Greenfield, Massachusetts, storehouse has reported the following items on hand:

	Approximately
Lead arsenate	107,000 pounds
Fish oil (50-55 gals. to drum)	100 drums
Barbed wire	11,000 pounds
Santomerse D	1,725 "
Creosote (50-55 gals. to drum)	23 drums
Spray hose, 1-inch	119,200 feet
Spray hose couplings, double lug, extras	472 sets
Suction hose, 2½-inch	1,425 feet
Horticultural Spray Base Oil (50-55 gals. to drum)	31 drums
Burlap strips, 8 inches wide, 7½ ounces in weight	80,000 yards
Twine, jute, in balls 10 to 16 ounces	6,500 balls
Tanglefoot (25-pound pails)	6,275 pounds
DDT (technical grade)	5,590 "
Xylene	400 gals.

The Wilkes-Barre, Pennsylvania, office has reported the following items on hand:

	Approximately
Lead arsenate	50,000 pounds
Fish oil (50-55 gals. to drum)	160 drums
Barbed wire	149 reels
Creosote (50-55 gals. to drum)	23 drums
Spray hose, 1-inch	92,250 feet
Spray hose couplings, double lug, extras	230 sets
Suction hose, 2½-inch	1,200 feet
Hose, low pressure, ½-inch (25 to 50 foot lengths)	58 lengths
DDT (technical grade)	3,850 pounds
Ultrawet 40A	1,799 "
Velsicol AR50	224 gals.
Wetanol	279 pounds
Xylene	400 gals.
Igepal, CA extra	31 "
Tanglefoot	700 pounds

Since the close of the fiscal year all of the lead arsenate, fish oil, barbed wire, Santomerse D, and creosote have been declared surplus; also most of the spray hose and couplings.